PEGASUS
Public Ecosystem Goods and Services from land management – Unlocking the Synergies

D.1.2
Maréchal, A., Baldock, D., Hart, K., Dwyer, J., Short, C., Pérez-Soba, M., Paracchini, M.L., Barredo, J.I., Brouwer, F., Polman, N.

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Deliverable 1.2: Synthesis report - The PEGASUS conceptual framework

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Project manager:	Anne Maréchal
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List of acronyms

- ESBOs: Environmentally and Socially Beneficial Outcomes
- EU: European Union
- GHG: ~~GreenHouse~~Greenhouse Gas
- H2020: Horizon 2020
- NGO: Non-Governmental Organisation
- PEGASUS: Public Ecosystem Goods and Services: Unlocking the Synergies
- PES: Payment for Ecosystem Services
- PDO: Protected Designation of Origin
- PGI: Protected Geographical Indication
- SES: Social-Ecological System
- SWOT: Strengths, Weaknesses, Opportunities, Threats
- WP: Work Package
- WTP: Willingness To Pay

1 Purpose of the report

This report provides a synthesis of the work carried out under Work Package 1 (WP1) of the PEGASUS project and it constitutes an official deliverable (Deliverable 1.2 (D1.2)) of the project.

One of the main aims of WP1, and hence this report, is to provide a unifying conceptual framework to underpin the programme of research activities within PEGASUS. The intention is to use a broadly framed approach which draws on, but is not confined by, the well-established concepts of "public goods" and "ecosystem services". This paper explores the potential for adopting such an approach, using a social-ecological systems-based framework to:

- Identify, classify and analyse the interlinkages between farming and forestry management systems and a broad range of 'environmentally and socially beneficial outcomes'[1];
- Understand better the social and ecological resilience of different farming and forest ecosystems;
- consider the drivers influencing or inhibiting the level and pattern of their supply and demand; and
- ~~reflect~~Reflect the benefits afforded to people by these environmental and social good and services and their appreciation by society.

The report builds on the first stages of research within the project[2] including literature reviews on the state of the art thinking and research in these fields and stakeholder workshops in the ten partner countries, undertaken as part of Task 1.1 of WP1 and presented in Deliverable 1.1 (D1.1).The report provides a short synthesis of the review of theories and concepts presented in D1.1 as this is necessary background to set the scene for the rest of this deliverable (Section 2). It introduces specific PEGASUS terminology (working definitions for the project) and detailed explanations about what the terms encompass in Sections 2 and 3, respectively. This report also presents the findings of the Task 1.2 on characterising existing linkages between land management actions and PG/ESS provision (Section 5) and of Task 1.3 on the methods and approaches to valorise and support public goods and ecosystem services provision (in Section 6). Finally, Section 7 sets out the agreed methodological approach for investigating the various topics explored in WP1. This 'conceptual framework' is intended to guide research activities under the subsequent WPs and, in particular, frame and guide the analysis within the case studies (WP4).

PEGASUS aims to formulate effective and novel approaches to land management decisions in the EU to take better account of, and enhance the delivery of public goods and ecosystem services in agriculture and forestry and prevent damaging activities in the long-term. The delivery of such goods and services is (most often) not sufficiently rewarded by existing

[1] This is the PEGASUS working term to describe social and environmental goods and services that have the potential to be generated from forest and farm management (see Section 3)

[2] Task 1.1 on the theories and concepts, Task 1.2 on characterising existing linkages between land management actions and PG/ESS provision and Task 1.3 on the methods and approaches to valorise and support public goods and ecosystem services provision

economic markets or mandated through appropriate governance responses. Recognising this, the project intends to explore and develop new ways to seek an adequate provision of public goods and ecosystem services by these sectors in the EU. This will involve initiatives both to actively enhance provision and to address forms of management that are causing provision to deteriorate.

It is now widely acknowledged that policy incentives over the past 50 years to encourage food, timber, feed, fibre or bio-based energy production in the EU have failed to prevent – and in some cases have contributed to a significant decline in the delivery of public goods and ecosystem services associated with rural landscapes (EEA, 2015). The general under-provision in these areas is now being exacerbated by climate change. In the face of this challenge, there has been an increasing recognition of a need to place greater emphasis on the provision of environmental and social goods and services from farming and forest ecosystems.

This is demonstrated by various commitments made by Member States and the EU, for example within the Common Agricultural Policy (CAP), the EU2020 Biodiversity Strategy, the 7th Environment Action Programme, aspects of Cohesion Policy and to some degree within the EU2020 strategy for 'smart, sustainable and inclusive growth'. The value of these benefits is increasingly acknowledged because of work undertaken in the last decade to clarify and deepen understanding of the extent and importance of ecosystem services (MAES, 2014-2015, TEEB, 2008). Today it is recognised that rural land, and appropriate agricultural and forestry activities on it, are both a vital resource for production of food, feed, timber, fibre and bio-based energy and a potential source of environmental and social goods and services of benefit to society such as climate regulation, habitat and gene pool protection, soil formation and composition, maintenance of water flows and hydrological cycles, or the cultural use and enjoyment of landscapes, many of which have public good characteristics to varying degrees.

Despite the societal benefits they provide, these goods and services continue to be under-valued in conventional markets and underrepresented in policy/institutional responses, with general under-provision or deteriorating trends observed, relative to societal needs or levels of appreciation. This situation reflects continued adverse market and societal factors and failures accompanied on the policy side by continuing governance and implementation insufficiencies and challenges.

To re-balance the position PEGASUS aims to explore approaches through policy, markets and stakeholders' individual and collective actions in agriculture and forestry. More specifically, PEGASUS will consider ways to prevent damaging practices, maintain existing good practice and introduce practices to enhance environmental and social goods and services, taking account of diverse conditions within Europe and the different scales (both spatial and temporal) of provision. At the heart of the project and key to developing the thinking are 32 participatory case studies (WP4) in ten different EU countries which will be conducted in the second year of the project. The conceptual framework, together with other preliminary research components in relation to mapping public goods and ecosystem services of interest at the EU and more local level (WP2) and the socio-political, economic

and institutional drivers affecting environmentally and socially beneficial outcomes provision (WP3), support the knowledge and evidence base needed for the case studies.

2 Towards a Social-Ecological Systems Approach

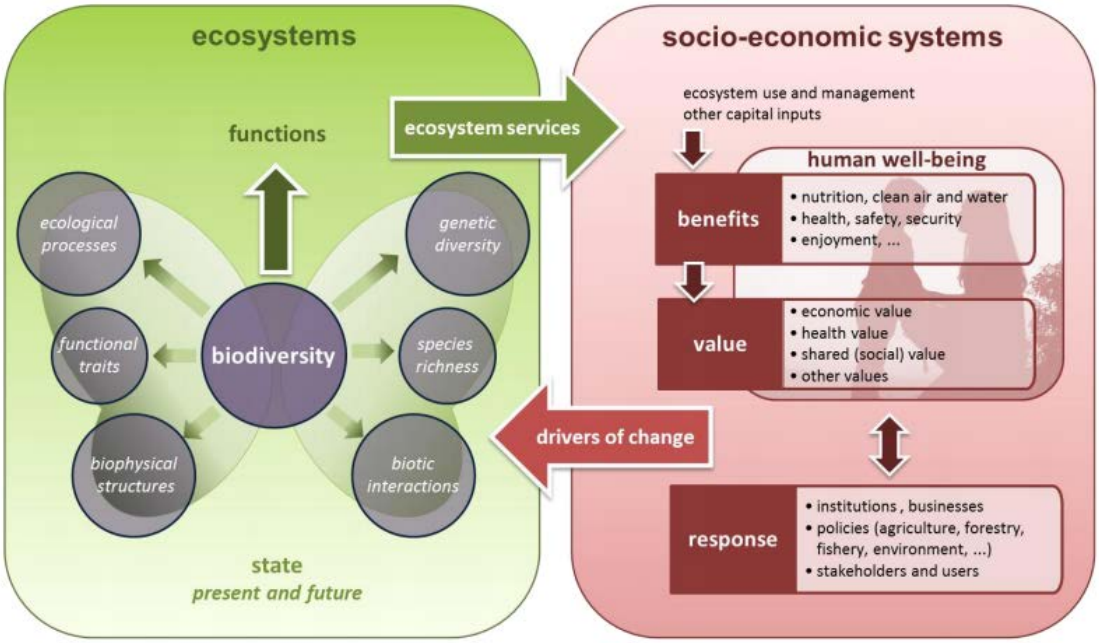
This section draws on the first PEGASUS deliverable (D1.1), written by Dwyer et al (2015)[3], and clarifies the application of the theoretical framework to the PEGASUS project. The conceptual basis for PEGASUS stems from two different academic concepts arising in different academic fields and for different purposes. Therefore both 'public goods' and 'ecosystem services' concepts, although framed differently, consider the provision of environmental and social benefits.

The concept of **ecosystem services** arose from ecological science. Ecosystem services are "the aspects of ecosystems utilised (actively or passively) to produce human well-being" (Fisher *et al,* 2009). The concept highlights the inter-dependency and feedback loops between countless ecosystem processes, elements and outputs, the 'services' they deliver to society, the derived benefits and how these are valued by society, including their functional and socio-economic value (Figure 1).

Numerous studies and research projects have come up with different ways to classify ecosystem services. The most widespread classification systems include the UN Millennium Ecosystem Assessment (MEA, 2005) and the CICES classification (2013)[4] which identifies respectively four and three types of ecosystems: provisioning, regulating, supporting (regulation and maintenance in CICES) and cultural ecosystems. Other literature sources (e.g. Fischer *et al.*, 2009) distinguish between intermediate (indirect) and final (direct) services, depending on their utilisation by human society. In PEGASUS, the most recent (2013) CICES classification is being used as the main reference while the MAES diagram (Figure 1) has been useful in deriving insights from the concept[5].

[3] Available on the PEGASUS website (http://pegasus.ieep.eu) and at: http://bit.ly/1RExIGQ
[4] Common International Classification of Ecosystem Services www.cices.eu
[5] The MAES model which draws on and develops this conceptual foundation (Figure 1) puts emphasis on the underpinning role of biodiversity in the delivery of many ecosystem functions from natural stocks and how these translate into services and subsequently benefits that may be valued by society.

Figure 1: The MAES 'butterfly' - conceptual framework for EU wide ecosystem assessments



Source: Mapping and Assessment of Ecosystems and their Services, 2013.

In relation to land management the ecosystem services concept encompasses both the production of food, feed, fibre and timber and environmental and cultural services. It aids our understanding of both the nature and the complexity of bio-physical relationships and how the human utilisation of ecosystems impacts on the provision of ecosystem services and the tensions, trade-offs and synergies between them. This is helpful in demonstrating how society and the economy in particular depend to a great extent on the multiple functions of ecological systems (in the case of PEGASUS, agricultural and forestry ecosystems); not just on certain specific functions (such as food or timber production). In this sense, the ecosystem services concept calls for a holistic/systemic governance approach to address ecosystems and the services they provide as a whole, rather than focusing on individual goods and services in isolation.

The **public goods** concept developed from economic theory (Samuelson, P.A., 1954) to refer to goods (or services) that are 'not rival' – if the good is consumed by one person, it does not reduce the amount available to others, and 'not excludable' – if the good is available to one person, others cannot be excluded from the benefits it confers. As a result, public goods are not adequately rewarded by economic drivers and there is usually market failure in relation to the supply of these "goods".

The public goods concept was introduced in agricultural policy discourse over the last two to three decades, often to argue for a new orientation of farm support under the CAP away from its historic objective of rewarding levels of production *per se* – for which the market is

assumed to provide sufficient economic incentive[6], to supporting more proactively the provision of environmental and social benefits where the market plays a more limited role (Buckwell *et al*, 1995). The provision of public goods in the forestry sector follows the same path, as those managing forest land have the potential to produce environmental and social goods/services beneficial to society but may not be rewarded economically for doing so.

The public goods concept focuses attention on the type and level of provision/supply of environmental and social goods and services needed to meet societal demand, where economic markets and policy/institutional structures do not provide sufficient incentives for farmers and foresters (or other land managers) to deliver these goods. In the case of market failure and for those goods and services that are valued by society, there is a case for societal action which may take various forms. These mechanisms may include market-strengthening action by which market conditions are created to make the provision of public goods more economically attractive. Other types of actions can alternatively be initiated, scoped and driven either privately or publicly, or collectively or individually.

However, the public goods concept has limitations in its application in certain areas. First, the term 'public goods' in practice encompasses goods that are often not purely public but exhibit different degrees of 'publicness', depending on their non-rival and non-excludable characteristics (see

[6] Although in some situations the market does not sufficiently recognise the importance of retaining a structurally diverse or sustainable agricultural system to produce these outputs.

Table 1). It may cause confusion for those outside economic disciplines as public goods can take the form of both physical entities – such as cultural landscapes or a specific habitat, or services – such as resilience in a landscape to flooding or fire; or even meta-level characteristics – such as the concepts of carbon sequestration or food security[7].

[7] Food security is a multi-dimensional term. In PEGASUS, 'food security' is used to refer to the maintenance / increase of a sustainable resource base, as a means to secure the long term capacity of the land to produce food. Other aspects of food security, for example the safe and secure access to food are not in the scope of this project.

Table 1: Degrees of publicness and rivalry and options for providing goods and services

	PRIVATE GOODS	CLUB GOODS	IMPURE PUBLIC/ COMMON POOL GOODS	PUBLIC GOODS
Degree of rivalry	Rival	Non-rival for small user group	Non-rival until a high level of use	Non-rival
Degree of excludability	Excludable	Excludable	Almost non-excludable - at a high cost hence reluctance to exclude	Non-excludable
Market provision	Markets work	Markets can work - subject to congestion if numbers grow	Markets likely not to work due to almost non excludability. If excludability is achieved, works as a club good	Markets likely to fail, unsupported local action likely to fail too
	As we move right, markets will have increasing difficulty in delivering an optimal allocation →			
Examples	Wheat Timber	Private parks Golf courses	Public access to farmed landscape Use of an aquifer	Stable Climate Clean water Biodiversity
Types of action ensuring provision	Private action	Local public or private action		Societal action is needed, e.g. public policy, legislation, institutional settings, etc.

Source: PEGASUS, 2015

In the farming and forest sphere, the social and environmental public goods and ecosystem services are often, albeit to varying degrees, *jointly* delivered with the private goods or provisioning ecosystem services, which are generally the core focus of these sectors. PEGASUS will, to the extent possible, seek to explain and exploit the joint nature of this delivery and use this characteristic as leverage for change and action in the agricultural and forestry sectors. The joint production element is helpful in promoting environmental and social benefits (e.g. in terms of awareness, proximity with land managers) but it can also hinder the delivery of such benefits as a successful outcome relies on the right balance in production between private and public goods and services[8]. Prevailing drivers often do not result in this outcome. With this in mind, PEGASUS will also explore also the relative merits of other solutions and approaches, particularly in relation to the delivery of environmental goods and services, for example the pros and cons of land sparing/land sharing approaches.

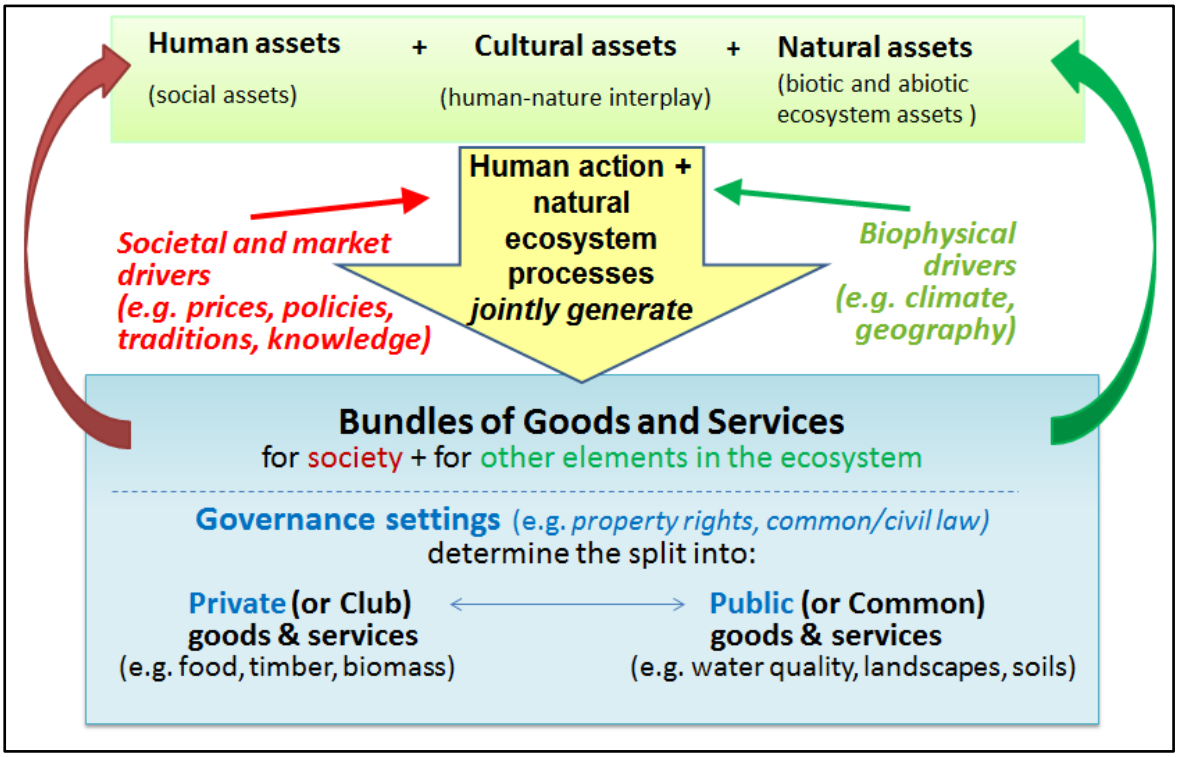
In respect of policy making, the synergies inherent in joint delivery of public and private goods and services provide opportunities to increase efficiency, but may in certain cases also bear a deadweight risk (i.e. incentive payments, unless very well targeted, can reward

[8] PEGASUS will not be limited to joint production and will explore other ideas, including land sparing, i.e. dedicating some areas to environmental delivery.

in some cases the provision of environmental and social goods and services that would be produced in any case). Ill-designed regulation can disincentivise the continuation of jointness, as can lack of intervention, thereby leading to damaging social and environmental effects.

Within PEGASUS, the initial review of relevant theories and concepts in Dwyer *et al*, 2015 (D1.1) explored ways of bringing the two conceptual frameworks together within a broader architecture, looking in particular at the potential value of the Social-Ecological Systems[9] (SES) framework for this purpose. The Social-Ecological Systems approach provides a wider compass by including human and social capital alongside natural capital in one holistic frame. It is not a replacement for the insights of both the public goods and ecosystem services concepts; rather it seeks to embrace the full set of dynamic relationships between natural assets and processes and human assets, actions and their respective drivers (Figure 2). The actions of farmers, foresters and others engaged in managing or influencing the management of rural land are particularly relevant here. It also shows how the goods and services produced by the system may be used directly or indirectly by a range of beneficiaries.

Figure 2: The Social-Ecological System in outline



Source: PEGASUS, 2015 adapted from Dwyer *et al*, 2015

[9] The SES framework emphasizes the integrated concept of humans-in-nature in order to stress that the delineation between social and ecological systems is artificial and arbitrary. The framework as used by (Berkes and Folke 1998, Ostrom 2005, Folke 2006 and McGiniss and Ostrom 2014) addresses the interplay and problem of fit between social and ecological systems by relating management practices based on ecological understanding to the social mechanisms behind these practices, in a variety of geographical settings, cultures, and ecosystems.

The Social-Ecological System approach highlights the role of institutions and governance, including the regulation of property rights, as critical in shaping the relationships associated with the management of natural resources which gives the approach particular relevance to PEGASUS. Both social needs and ecological integrity are encompassed with due emphasis on the long-term health, resilience and sustainability of the system. People form an integral part of the system, with human capital and societal action placed on an equal footing with ecological processes in relation to securing the delivery of goods and services. In this way it highlights the role of land managers and farming and forestry enterprises both in economic terms and in schemes of governance (see Figure 2). Collective action[10] is revealed as particularly important to achieve harmonised human interaction with the farming or forest ecosystem.

Several aspects of the SES approach should be captured through the participatory methodology and 'action research' focus of PEGASUS, which places farmers, foresters and other stakeholders at the centre of the project. The daily land management decisions of these stakeholders have a direct impact on the provision – or non-provision – of a range of environmental and social goods and services.

The potential offered by collective types of actions is of particular relevance to the study. In this context, it has been a priority to engage key stakeholders at an early stage of the project, not least in the ten national workshops.

The review of theories and concepts summarised here has shown that the two concepts of public goods and ecosystem services each has added-value for the PEGASUS analysis and contributes a distinct perspective. The social-ecological system concept adds further value for several reasons. It provides a more systemic and inclusive lens through which to examine farming and forestry and the measures or actions (private or public) required to strengthen the provision of certain environmental and social benefits. The relevance and robustness of the SES as a framing concept will be explored through the case studies with a view to developing a practical toolkit that aims to operationalise the concept for stakeholders, as well as recommendations for changes to and novel approaches for EU, national and local policy.

The concepts reviewed have been used to structure the table presented in Annex 1, which identifies the set of environmental and socio-cultural beneficial outcomes that are of most interest for PEGASUS, at this stage in the project.

3 Terminology and focus of PEGASUS

The detailed review of theories and concepts summarised above has enabled us to clarify the scope of the project and to refine the terms used in a way that is coherent with both public goods and ecosystem services concepts. In light of the holistic SES framework,

[10] In PEGASUS, collective action is taken to mean action taken by multiple actors, working together, rather than by individuals working independently. Collective actions can take place at different scales, from local to nation-wide or EU-wide levels.

PEGASUS has introduced a new internal working term for use within the project, '***environmentally and socially beneficial outcomes', or ESBOs.*** This term captures the scope of the desired social and environmental outcomes for agriculture and forestry which the project seeks to enhance, through a consideration of how their provision can be enhanced via agriculture and forest management at the same time as producing food, feed, fibre, timber, energy, etc.

In the European context applicable here, 'environmentally and socially beneficial outcomes' are understood to be those outcomes in the environmental and social spheres that are delivered by agriculture and forestry and which benefit society. This term thus includes:

- Ecosystem services, and their resulting benefits[11], that have public goods characteristics (environmentally beneficial outcomes), and;
- Social and cultural outcomes delivered by farming and forestry with public goods characteristics – this includes 'cultural' ecosystem services as defined in the CICES framework (see Section 2).

Located at the crossroads between the public goods and the ecosystem services concepts, the term environmentally and socially beneficial outcomes brings forward the essential ideas that are at the core of the project:
1 - It captures the insights from both concepts viewed through a societal prism, which determines what does or does not contribute to human well-being. The scope of the project is thus on outcomes that are beneficial to society, with 'beneficial' used in a broad sense as it embraces not only those positive practices enhancing the provision of ESBOs but also those reducing the occurrence and impact of negative practices that actively reduce the level or quality of their provision[12];
2 - The term is also a reminder that PEGASUS is concerned with both the environmental and social dimensions of agriculture and forestry management, and how these can be balanced with the production of food, feed, fibre, timber, energy, etc.

Agricultural and forestry activities are very diverse and they can have both positive and negative environmental and social impacts (so-called 'negative externalities'). The impact of protection may vary considerably depending on the management systems and practices being implemented, the individual management operations undertaken as well as a range of other factors, notably the local biophysical context. Negative impacts often may not be intended to be damaging; the perception of the actions concerned are diverse. Ironically, some negative results may arise from positive intentions. With this in mind, mitigating the impacts or occurrence of practices that have a negative impact on ESBO provision is as important as enhancing practices that have a positive impact. Both are considered within the frame of this project.

PEGASUS takes a European perspective on these issues. Nonetheless, the global dimension will be considered to the extent feasible, not only in relation to demand but also in relation

[11] In the sense of Figure 1

[12] Furthermore, it is noted that the ESBOs belong to different categories within each of the two concepts from which they derive: they can be "public" goods or services to varying degrees, others broadly take the form of ecosystem functions, services, or benefits.

to supply, where the pursuit of a more balanced provision of ESBOs may have repercussions outside the EU, for example if it stimulates food/feed/timber production in third countries.

4 The intended environmentally and socially beneficial outcomes addressed within PEGASUS

The purpose of PEGASUS is to identify how the delivery of environmental, social and economic benefits from agriculture and forestry activities can be improved by finding new or enhanced private and public, collective or individual, mechanisms for doing so. Annex 1 presents the range of environmental and social goods and services from agriculture and forest ecosystems on which the project will focus, at least initially. These environmentally and socially beneficial outcomes are presented in tabular form which sets out how different goods and services relate to the concepts of public goods and ecosystem services.

The first and the second columns of the table respectively identify the broad categories of objectives and more specific goods and services, or 'beneficial outcomes', that PEGASUS is seeking to achieve in agricultural and forest ecosystems. The beneficial outcomes may be of an economic, environmental and/or social (or socio-cultural) nature.

The ESBOs are formulated as the ultimate desired outcome, where the description seeks e.g. the "maximisation" [13] of the provision of a given ESBO in a given context. The desired level of provision is not generally quantified because sustainable thresholds or levels of resilience will vary according to different regional circumstances and often data are not available to determine these thresholds or tipping points[14].

The third column describes each beneficial outcome in more detail to build a common understanding of what is meant in a more explicit or precise way. Except where this is defined by legislation or by broadly common standards (e.g. water quality, air quality), the precise sustainability threshold level may be difficult to determine and is likely to vary from one situation to the other (for example to achieve a given level of soil functionality might entail different soil structures, composition, management, etc. in different circumstances). Therefore informed interpretation at the local level is needed. Moreover, it is acknowledged that not all the benefits listed in the table can be achieved at the same time on the same plot of land (or are relevant, e.g. flood protection in certain regions) but the rebalancing of environmental, social and economic outcomes sought in PEGASUS implies the simultaneous pursuit of a range of goals.

The fourth and fifth columns describe what insights can be brought to bear from the ecosystem services and the public goods concepts. The insights from the ESS concept (fourth column) inform the reader about the nature of the specific ecosystem service contributing to the economic, environmentally or socially beneficial outcome(s) while the

[13] Maximisation and minimisation levels as determined by society's demand (see Section 6.1)

[14] As ESBOs encompass different things within each of the two concepts from which they derive, this makes the definition of a quantified threshold complex and not always appropriate.

insights from the PG concept summarise the extent to which markets alone can be anticipated to provide an optimal outcome.

The intended beneficial outcomes table constitutes a first consolidated list of environmental, social and economic outcomes from agriculture and forestry to be examined in PEGASUS. The development of this list has helped to inform a literature review under Task 1.2 looking at the relationships between different types of land management and desired benefits. It will be used as a basis to identify relevant proxies for mapping these linkages across the EU under WP2. The table also provides a useful framework for the case studies in which questions will be asked concerning the reasons for the relevant environmentally and socially beneficial outcomes not being delivered optimally, and how they might be delivered better in future - via policy or other initiatives. It is planned that all goods and services identified in the table will be covered to some extent through case studies and it is possible that others not noted here may also become apparent through this phase of the research.

5 Relationship between farming and forestry systems and the provision of environmentally and socially beneficial outcomes

This section summarises key messages from the literature review undertaken under Task 1.2, scoping the functional relationships between primary production within agriculture and forestry systems and the delivery or non-delivery of 'environmentally and socially beneficial outcomes'. It examines some of the main farm or forest-level factors (e.g. intensity of management, type of production system) shaping these relationships.

A first literature review spanning largely ecological science sources has analysed the contribution of management practices in different agriculture/forestry management systems[15] to 12 relevant ecosystem services (ESS) providing primarily environmentally beneficial outcomes, as follows: carbon sequestration, erosion protection, fire protection, flood protection, water quality, water quantity, air quality, pest and disease control, pollination, wildlife diversity, landscape character, public access to the countryside and public outdoor recreation. The scientific evidence base for the analysis was a review of 258 scientific articles covering different aspects of the nature of the linkages between farming/forestry systems and the parameters above. Topics of interest in this research included the synergies or trade-offs with other beneficial outcomes; spatial and temporal scales and the degree of 'publicness' of the environmentally and socially beneficial outcomes delivered. The literature review did not cover the relationship between agricultural/ forestry practices and damaging outcomes.

[15] The CAPRI classification was used for farming systems (specialist cereals, oilseed and protein crops; general field cropping + mixed cropping; specialist dairy; specialist cattle rearing and fattening + dairy, rearing and fattening combined; sheep, goat and other grazing livestock; specialist non ruminant; mixed livestock holdings; mixed crop-livestock; specialist vineyards; specialist fruit and citrus fruit; specialist olives; various permanent crops combined; specialist horticulture; non-classifiable holdings). For forestry systems, these were grouped in 3 categories: i) protected forest (nature conservation); ii) multifunctional forest (pursues two or more outcomes keeping a balance between functions); and iii) production forest (timber production).

The methodology used for framing the literature review partly builds on the FP7 OpenNESS project database[16], the focus of which was on the linkages between natural capital and ecosystem services. Improvement, expansion and tailoring of this methodology to the broader PEGASUS frame also involved investigating the extent to which documented linkages could be mapped spatially and temporally, identifying any limitations in mapping such as dataset limitations to the representation of natural capital and flows, spatial resolution issues, accuracy of proxy indicators, availability of time series data, etc. This provided preparatory materials for later work in PEGASUS WP2[17] which is the focus of a separate deliverable.

The findings of the literature review suggested a number of general relationships tempered by some important caveats, as follows:

- *Local context matters*: Linking specific management actions to delivery of generally positive or negative environmental outcomes often is context dependent, with certain management practices delivering positive outcomes in one location but negative in another context. Moreover, some beneficial outcomes are relevant only in specific geographical regions, e.g. fire protection via activities such as grazing and vegetation control is well studied and particularly relevant in the Mediterranean region but much less so in other regions. Geographical location and context are therefore key factors to take into account.
- The *geographical scope* of the literature analysed was very broad and ranged from global review papers to those concerned with specific climatic zones, from a continental scale (e.g. American agricultural systems) to individual countries or regions.
- *Temporal scales* need to be taken into account. Some benefits or costs are immediate; others may emerge only after a transition period in which ecosystems adapt. A multiannual temporal scale is needed for many of the environmental benefits (or damage) delivered by farming while the timescale in forest ecosystems is usually longer. Temporal scales are also relevant to social benefits.
- The majority of ecological papers reviewed considered management change and its impact on environmentally and socially beneficial outcomes under *experimental conditions*, greatly limiting the extent to which results can be extrapolated to a wider scale. However, this was less often the case in respect of social science papers.
- The *synergies* and *trade-offs* between environmental and social goods and services were rarely the focus of the research papers reviewed although they are important.

The interaction between the management of agriculture and forest ecosystems and environmentally beneficial outcomes delivered were analysed separately.

For **agricultural ecosystems** ('agroecosystems'), the literature review shows that there are established linkages between management practices applied within agricultural systems and the delivery of environmental ecosystem services (ESS). Three sets of agricultural management practices have been identified as synergistically contributing to the occurrence

[16] http://www.openness-project.eu/

[17] The focus of PEGASUS' Work Package 2 (WP2) is to assess links between land management and the provision of public goods and ecosystem services.

of environmental ESS in most of the situations described in the reviewed literature: soil conservation, maintenance of topographic elements (e.g. semi-natural vegetation) on agricultural land and reduced fertiliser and pesticide use. Together, these "positive" agricultural management practices were found generally to contribute to carbon sequestration, erosion protection, flood protection, water quality regulation, water quantity regulation, air quality regulation, natural biological control, pollination and wildlife diversity.

The *maintenance of topographic elements* such as hedgerows, patches of natural vegetation, forest edges or field margins was found to make a positive contribution to a range of ecosystem services, including flood protection, natural biological control, pollination and wildlife diversity. For instance, beetle banks and field margins in arable crops are particularly beneficial for enhancing biological control; maintenance of riparian vegetation and buffer strips along watercourses contributes to enhanced flood protection and water quality regulation services.

Reduced tillage practices (e.g. no tillage, minimum tillage or conservation tillage) can help to avoid or reduce the release of carbon to the atmosphere in many circumstances, which indirectly contributes to carbon sequestration (although the benefits are mainly limited to arid areas), to limit soil erosion, to improve flood protection capacity by limiting soil compaction, to improve air and water quality and to have a positive effect on water supply thanks to increased water retention in soil and stubble.

Reduced use of fertilisers and pesticides positively impacts on water quality and its regulation, natural biological control and pollination.

The linkages between agricultural management practices and cultural ecosystem services - landscape character and recreation – are more complex. The character of the landscape is linked to the nature of the production system in place. Although traditional and extensively farmed types of landscape very often generate high levels of public appreciation, this also can be true for specific intensive landscapes like certain vineyards. The same pattern applies to some extent to recreation in the countryside (i.e. enjoyment of outdoor areas). It is difficult, therefore, to establish clear linkages between management systems and the occurrence of these cultural ecosystem services since cultural relationships with and appreciation of these ecosystem services is subject to variations within the EU in several respects.

While the linkages between extensive agricultural practices, particularly the management of semi-natural grasslands, and environmental ESS is widely recognised, the literature shows that, under appropriate management, some environmental ESS can also be delivered in intensive agricultural areas, although the extent to which this is the case varies depending on the type and location of the management carried out. The synergies and conflicts between the different management practices are far from simple and some need to be assessed within specific regional conditions.

In the case of **forest ecosystems**, establishing patterns in the relationship between ESS supply and types of forest management appears to be more difficult from the literature examined since there are many other factors at play. Three very broad and simplified types

of forest management were identified for use in this exercise: production forests, multifunctional forests and protected forests.

Generally speaking, *production-oriented forest systems*, particularly the intensive ones, have negative – albeit varying – impacts on carbon sequestration, flood protection, water quality regulation and wildlife diversity. By contrast they often have a positive impact on water quantity supply levels, since in production forestry clearcutting operations generally increase water infiltration rates (by decreasing evapotranspiration). In addition to the findings of the literature review, it is noted that some specific productive forests under sustainable management (e.g. certain Boreal forests) are sometimes able to maintain a high growth rate of biomass which can result in higher carbon sequestration rates than in old protected forests because of higher rates of aggregate growth.

Protected forests and those of equivalent character have a positive impact on carbon sequestration and wildlife diversity as well as other ESS generally (although this was not identified in the selected literature), notably protection from soil erosion, flood protection and water quality, thanks to the dense root systems likely to develop in these forests. There are also generally positive impacts on landscape character and if public access is allowed, recreation.

The impact of *multifunctional forests* is complex to analyse given the range of species, biophysical structures and silvicultural operations that can be used in the diverse types of forest in this broad category. The level of many ESS can be increased where there are locally appropriate tree species in appropriate locations and subject to sensitive management. For example, depending on the state of the forest, management operations in a multifunctional forest can relate to thinning in one situation or to afforesting in another, with different implications in terms of ESS delivery. The analysis of the linkages between the two thus needs to be undertaken more precisely at the level of individual conditions and silvicultural operations where possible. A number of factors determine which are the most appropriate tree species for precisely which locations in respect of different objectives.

From the literature review, some management practices such as thinning and selective cutting were found to have a generally positive impact on fire protection, natural biological control (enhancing tree vigour) and on scenic beauty/landscape character in some cases. Other practices, including slash removal and management through prescribed fires, (most common in multifunctional and production forests), generally contribute to fire protection.

All types of forest management have an impact on the capacity of trees to reduce atmospheric pollution and therefore their capacity to regulate air quality. No difference was found between production-oriented and protected forests as long as the biophysical structure of forests is maintained. Rather, other factors not linked to the type of management, such as the location of the trees/forests (close to roads and other sources of

pollution) and the type of species (with coniferous trees delivering a greater contribution than deciduous trees[18]) appear to be more relevant to achieving air quality regulation.

As in the case of agroecosystems, the consequences of different forest management approaches for landscape character and recreation are neither uniform nor unequivocal, as they are to some extent based on individual judgement and appreciation of particular characteristics. For example, thinning in production forests can be associated with higher scenic beauty by some and not by others, while a dense protected forest can block the view of the surrounding landscape and therefore potentially could be associated with a negative impact for certain groups in society. It is noted that protected forests generally provide a habitat for a range of wildlife which can be an important aspect of many benefits they deliver for recreation purposes. It should be noted that in some Member States such as Finland, production-oriented forests often are open to the public and thus also offer recreational benefits to society.

In terms of the importance of *management*, establishing the relationships between the different types of management practices in different agriculture and forestry systems and the provision of ESS and benefits in general terms is possible only in certain areas and often to a limited extent. The importance of the spatial dimension must be stressed; beneficial outcomes may depend on the location of the activity. Most of the positive correlations emerging from this literature review need to be tested and verified in specific conditions, including at the regional/local scale and even the farm level in some cases. In fact, the linkages between the management actions undertaken and the provision of beneficial outcomes are to a great extent spatially dependent at a very local level, e.g. trees have a greater potential to clean air if located close to roads or polluted areas; a grass buffer strip located at the bottom of a steep field would have a greater positive impact on water quality (and perhaps less on other ESBOs) than if located at the top of the hill. As a result, the same outcome might be achievable by a variety of different types of management in different parts of the EU, depending on the local context and the pattern of synergies and conflicts between management actions and resulting ESBO provision.

In conclusion, management practices in agriculture and forestry are a key factor that has, in all situations, the potential significantly to contribute to the provision of a wide range of beneficial outcomes – or to curb their decline and/or under-provision. However, the degree to which particular management practices effectively help to deliver environmental ESBOs will depend on a range of factors which goes far beyond the agriculture or forest management system in place. Other considerations playing a relevant role in the delivery equation include environmental factors (e.g. soil type, environmental zone, rainfall, altitude, topography, vegetation patterns, etc. – all of which are highly variable across Europe) but also market/economic, policy, institutional and social factors, *inter alia*.

[18] This is because coniferous trees have a larger filtering capacity than trees with deciduous leaves due to the larger total surface area of needle which capture larger amounts of particulate matter than broadleaved trees (Freer-Smith *et al.*, 2005). This capacity is also greater because the needles are not shed during the winter, when the air quality is usually worse.

Finally, it is worth stressing that there are also inevitable *trade-offs* between the provision of the various environmental and social goods and services, as well as issues relating to the degree of jointness between environmental, social and economic outcomes from agriculture and forestry activities (Howe *et al.,* 2014).

A second and more social-science focused rapid review has examined literature on the linkages between agriculture and forestry management practices and the provision of five relevant socially beneficial outcomes:

- *animal welfare,*
- *recreation and education,*
- *public health,*
- *rural vitality, and,*
- *food security* (in the sense of the maintenance of the natural resource base for a long term food supply).

In terms of *animal welfare*, there are obvious linkages between the types of farm management practices employed, the care with which they are undertaken and the resulting level of farm animal welfare. Animal welfare is a comparatively regulated area, with EU legislation covering different aspects relevant to farmers such as housing, health and behavioural requirements. Rules apply also to other operators along the supply chain such as those transporting live animals and those responsible for slaughter. Individual farmers' management decisions on animal welfare have the potential to contribute to animal welfare to varying degree. High levels of animal welfare can be associated both with: a) good practice in terms of specific forms of treatment, housing nutrition, transport, etc. and b) systems with potential for enhancing welfare, for example those which provide ample space for animals to express more natural forms of behaviour. Poor welfare can arise in any system however.

Farming and forestry activities on rural land can also contribute to the provision of public *outdoor recreation and educational activities* particularly in attractive landscapes and *public health* through the therapeutic benefits of contact and engagement with nature especially for people with health challenges of various kinds, both mental and physical (Hassink *et al*., 2013). This represents a further form of potential benefits which can arise from a general experience of the managed countryside or more active participation in farming/ forestry activities.

While no specific evidence was found on the impact of different types of farming or forest systems on *public health and social inclusion*, the provision of these benefits from the natural environment in general has been well documented in De Vries *et al.* (2003) for example. This work shows that living in natural ecosystems is positively correlated to a number of positive health indicators, including the perception by people of being in better general health. Ten Brink P. *et al.* (2016) more generally demonstrates the "undisputable link between green areas and health and social benefits". Green infrastructure in cities and accessible natural areas delivers such benefits, in particular when located close to urban areas. The study reviewed literature showing that being in contact with nature can support health and wellbeing in different periods of life. Nature areas can notably contribute to children's development in particular (enhancing concentration, physical activity and motor

skills, self-esteem, and emotion regulation; Faber Taylor and Kuo, 2009). Nature has restorative and stress reducing effects as shown by people's mood and positive feelings increase after being in urban green areas (well-constructed urban park and city woodland) compared to the city centre (Tyrväinen *et al*., 2014). Some evidence shows that natural environments lower blood pressure and pulse rate as well as reduce cortisol level (e.g. Horiuchi *et al*., 2013). Forests and parks are also used for therapeutic interventions.

According to Ten Brink P. *et al.* (2016), although protected area status is not an essential prerequisite, Natura 2000 sites and other protected areas appear to facilitate the delivery of health and social benefits for a number of reasons. For instance, their governance frameworks (based on e.g. stakeholder engagement, activity at the level of the community, capacity to attract funding), their recognised biodiversity/environmental value, or the likely presence of physical infrastructure in those areas - which improves the public's experience - indirectly contribute to a generally greater provision of health and social inclusion/rehabilitation benefits to the public or community. The study identified some 20 examples across the EU including the Rāzna National Park in Latvia, where the "Green Routes without Obstacles" programme aims to increase the availability of nature-based tourism for disabled people, providing them with equal opportunities and access to this protected area. In Vienna, Caritas Austria has launched the concept of "neighbourhood gardens" which bring together care home residents and volunteers and enable new social interactions and co-learning. More directly linked to agriculture and forests, the Care Farms network in UK offers therapeutic and social rehabilitation through farming and forestry to those from other walks of life.

Rural vitality is primarily a social outcome but with economic, cultural and other dimensions. It may be reflected by various socio-cultural and economic indicators such as the extent of development of farmers/foresters local groups, viable business models in the area leading to adequate employment and incomes, the cultural richness of local communities and practices, the depth and diversity of knowledge and traditions, levels of equal opportunity and status for men and women, among other factors. There are no rules as to what specific type of farming/forestry management system is more or less able to contribute to rural vitality, although it is noted that in areas where agricultural/forestry profitability is greater, it may be more likely to achieve generational renewal or attract new businesses, and thereby to maintain a resilient rural population base.

Finally, the linkages were examined with respect to "*food security*", which, in the PEGASUS project, refers exclusively to the maintenance of a natural resource base to ensure the sustainable, long-term supply of food to future generations. Under this definition, any farming or forestry management systems able to achieve and maintain environmental and social resilience can provide long-term food security. Food security thus depends upon the system's provision of a range of environmentally and socially beneficial outcomes, at sustainable thresholds of delivery. In this context, it appears likely that certain agricultural and forestry systems, particularly those that are extensive and which have a coherent structure of good practices are more able to deliver a range of environmental and social outcomes, in a holistic way (especially for biodiversity and landscape character ESBOs) over the long term. At the same time, a variety of individual practices going in that direction may be deployed in a range of production systems, including more intensive systems e.g. carbon

sequestration, reduction of GHG emissions, landscape character, etc. contributing to a more robust resource base (Cooper T. *et al,* 2010).

In the case studies, the nature of the linkages identified in this review will be tested. The project will therefore seek to provide a local, case-based understanding in different European regions of synergies and conflicts between the occurrence of environmentally and socially beneficial outcomes and management practices in different farming and forest systems, while taking account of other related factors. The aim is also to highlight what specific mix of influences and drivers has led to the establishment of hotspots or cold spots (i.e. the under-provision of targeted benefits) in the regions considered.

6 Societal appreciation, valorising environmentally and socially beneficial outcomes and determining supply and demand

This section draws on and expands from the literature review and inputs from Task 1.3[19] as well as key messages emerging from ten SWOT[20] analyses of 'valorisation' mechanisms used to add value to and increase the appreciation of ESBOs in the case study countries. It also reflects relevant aspects of the discussions with stakeholders and experts held during the ten national workshops.

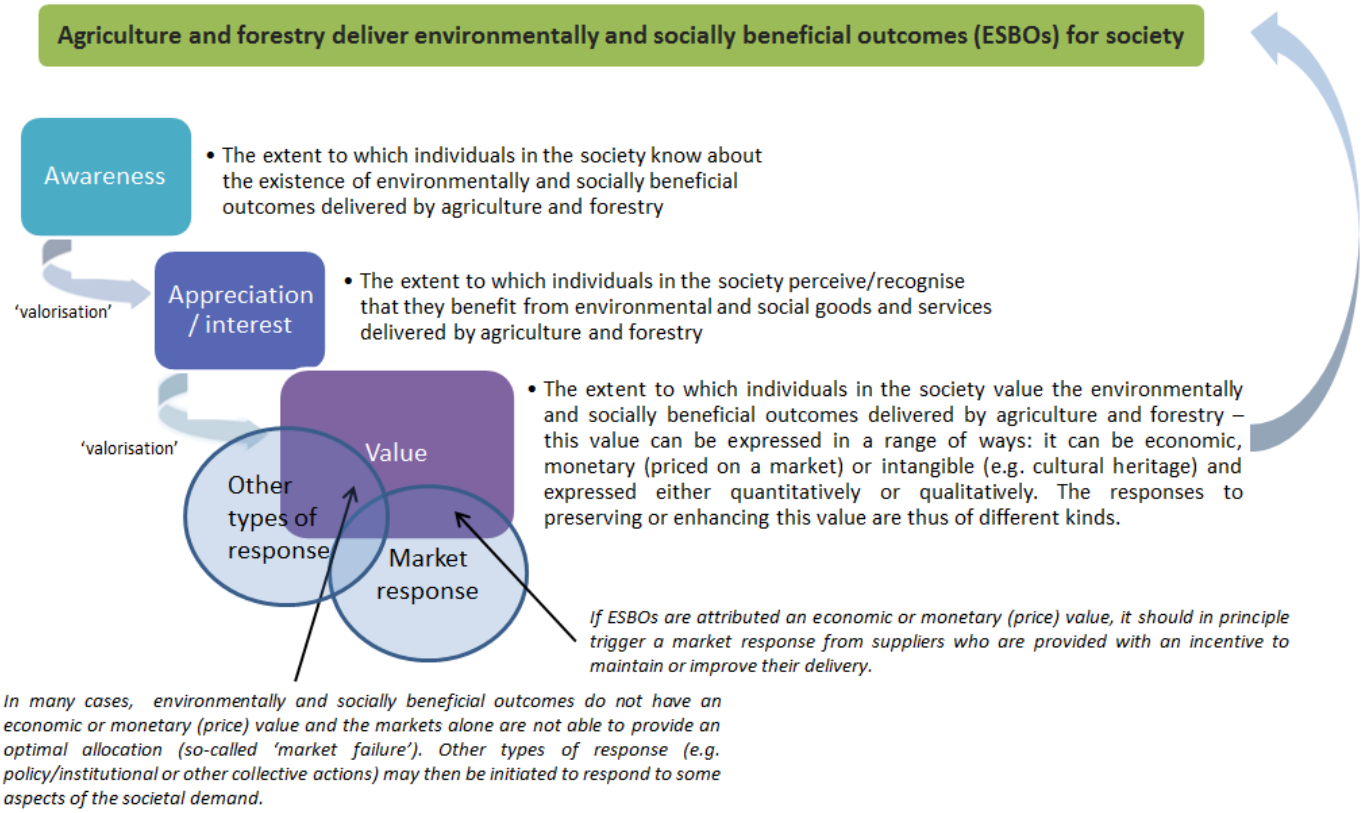
6.1 Public awareness, appreciation/interest and value – the cascading 'valorisation' model

Although not straightforward to quantify, there is evidence to demonstrate that the environmental and social goods and services delivered by the agriculture and forestry sectors are valued by society and as a result, that there is societal demand for the beneficial outcomes concerned (Cooper *et al*, 2010; Bureau et Mahé, 2008; Van Berkel and Verburg, 2012). This can be determined in a variety of different ways (see below). The PEGASUS project hypothesises that although in many situations the current level of provision or supply of environmental and social goods and services does not meet the level of societal demand in the EU (EEA, 2015) (for example when policy targets are not being met), there is potential to address this shortfall, by means to be further explored in the project.

Societal demand for environmentally and socially beneficial outcomes delivered by these sectors can be represented as a cascading process in which the different elements of what we decide as a valorisation process are expressed along the successive steps within a value stream (Figure 3).

[19] Review of valorisation methods supporting the delivery of public goods and ecosystem services
[20] Strengths, weaknesses, opportunities, threats

Figure 3: Cascading 'valorisation' chain for the environmentally and socially beneficial outcomes delivered to society by the agriculture and forestry sectors



Source: PEGASUS, 2015

Note: Valorisation is understood in this context to be the process by which an existing good or service becomes more valuable in someone's perspective (i.e. individuals in society) through actions which result in its value being more recognised and enhanced. For PEGASUS, the valorisation process refers particularly to increases in stakeholder awareness, interest/appreciation and the value attributed by society to the environmentally and socially beneficial outcomes delivered by agriculture/forestry.

In the first step of the valorisation process, **awareness** refers to the extent to which both the public as a whole and local stakeholders (including land managers) are aware of the presence of the environmentally and socially beneficial outcomes being delivered by activities on agriculture and forest land in their areas. This applies both to the supply and demand side. Land managers are citizens with their own awareness, knowledge and preferences which is relevant to their capacity and willingness to deliver ESBOs.

Awareness could also refer to the recognition of the potential for this delivery in areas where under-provision has occurred. In fact, the local population in localities where there is an abundance of environmental and social goods and services ('hotspots') may or may not realise the multiple benefits they receive from the provision of these goods and services, whereas the under-provision of environmental and social goods and services often triggers awareness that these are lacking. Therefore, although awareness is in principle likely to be greater in hotspot areas, it is not limited to these areas as awareness of the benefits of environmental and social goods and services is not correlated necessarily with their provision within a particular locality.

Public awareness is closely linked with an active **interest and appreciation** of the provision of these environmental and social goods and services and the recognition that society benefits from them. As shown in Figure 3, raising awareness is a prerequisite for the appreciation of public goods and ecosystem services by society as well as their supply by land managers. The PEGASUS workshop in Slovenia highlighted the key role that education or training can play in this regard. Creating partnerships of local stakeholders (including private sector, NGOs, experts and public sector regulators) can also be an important means to strengthen the appreciation of public goods (e.g. WBCSD, 2012). Public awareness and appreciation are also greatly impacted by policy discourses, media attention and social networks. Such interactions should be based on robust evidence to ensure that the discussions and conclusions drawn by those involved are scientifically sound. Typically public appreciation is greater for tangible goods and services, such as water quality or species rich habitats (e.g. woodlands, meadows) than for intangible benefits such as carbon sequestration or reductions in greenhouse gas emissions, the effects of which are invisible and impact at the global scale.

In the cascading valorisation chain, where there is appreciation and interest in the various environmental and social goods and services deriving from agricultural and forest activities, this implies that they are valued by the public which recognises the societal benefits deriving from these goods and services (TEEB, 2010; OpenNESS, 2012-2017; OPERAs, 2013-2018). This **value** can be either implicit (i.e. assumed within institutions, legislation, attitudes or behaviours) or economically explicit (i.e. visible through some tangible economic or monetary variables) and the expression of this value demonstrates the existence of some form of societal demand for these goods and services (Robinson *et al.*, 2014; van Berkel and Verburg, 2012).

Where value is economically explicit, it can be translated into an economic and monetary value where suitable conditions are in place (van Berkel and Verburg, 2012; Daniel *et al.*, 2012). In principle, this can provide market actors with economic incentives to maintain and enhance the provision of those environmental and social goods and services that generate the higher market value (‘market response’). Examples of the types of benefits that are perceived as directly contributing to value creation and which can trigger a market response include certain characteristic cultural landscapes which benefit the tourism and recreational sectors directly (Slee, 2011) and which also contribute indirectly in various ways (higher land/property prices, stimulating some supporting economic activities such as catering, accommodation and cultural activities). A range of environmentally and socially beneficial outcomes (e.g. landscape character, diverse species and habitats, healthy soils, water quality, animal welfare, etc.) also contributes to adding value to products compliant with higher levels of standards or specific quality rules. These may be specialty/labelled products sold at a price premium to final consumers (e.g. PDO/PGI products, organic products, environmental labels on timber) or intermediaries in the supply chain (e.g. in the Netherlands some dairy cooperatives are willing to pay a higher price for milk from outdoor grazed cows). The provision of some environmental and social outcomes can give rise to economic benefits in the form of cost-savings (rather than value creation), as in cases where the therapeutic benefits of farming and forestry contribute to reduced health expenditure, or where higher animal welfare results in reduced stock replacement rates or veterinary bills (Dutch workshop).

Where value is implicit, other signs of public appreciation often are visible outside the market. For example it may include the introduction of public policies and private initiatives to address an issue and the involvement of voluntary groups and organisations to tackle it. Societal concern for the degradation of environmental and social goods and services is also shown by a growing body of legislation and an increase in research outputs investigating these topics (Martinez-Harms *et al*, 2015; Bateman *et al*, 2013). Other useful proxy indicators include individuals' engagement through donation to or membership of collective action groups/NGOs and so-called 'lifestyle choice' factors measured by sales of consumer products or services offering specific environmental or social standards including e.g. eco-tourism, organic food, fair trade goods[21]. Behavioural change in response to increased awareness can also be measured in respect of many other more general practices such as adopting water-saving activities in sensitive areas. These indicators reflect citizen/consumer decisions but may not correspond to levels of appreciation *per se*[22]. Nonetheless, increases in these indicators[23] over time in many parts of the EU suggest a trend of growing societal appreciation of environmentally and socially beneficial outcomes from farming and forestry.

While this section is mostly concerned with the process by which demand for ESBOs can be enhanced – in the hope that this will activate supply mechanisms, it is worth noting that to a large extent, the response from those able to 'supply' or act upon the delivery ESBOs follows a similar cascading process. Farmers, foresters and others involved in farming and forest management may, through general public media or professional channels, become aware and interested in ESBO delivery and appreciate these beneficial outcomes, which in turn has the potential to lead them provide such outcomes in their management choices. This explains why some mechanisms aiming to influence either demand or supply often tend in practice to influence both at the same time (see Section 6.3).

6.2 Determining societal demand

Determining more accurately the level of public demand requires finer estimates of the variety and depth of different expressions of value attributed by society to environmental and social goods and services from agriculture and forestry.

Different **valuation methods** have been used which attempt to measure/quantify the economic or monetary value of non-market goods and services in the environmental and social fields. These include methods to measure people's Willingness-To-Pay (using contingent valuation methods or choice experiments), estimates based on hedonic price analysis, i.e. the amount of money people are willing to spend to e.g. travel to a specific

[21] These often come at a price premium which shows that some groups are willing to pay for these benefits (see valuation).

[22] The proxy indicators exclude those people who are aware and appreciate environmentally and socially beneficial outcomes but who do not take action for various reasons - social, cultural, educational, economic or individual reasons (e.g. time/budget constraints, lack of involvement culture, limitations as to what can be done as an individual). On the other hand, they may include people who are driven by other reasons, e.g. purchasing low consuming lightbulbs for economic reasons only.

[23] For example, the demand for organic farming products has pushed organic farming area to expand by 500,000 ha/year between 2003-2013. Facts and figures on organic agriculture in the European Union, Organic Monitor, September 2013

area, live in a specific area, etc., and various proxies that estimate the actual monetary cost of delivering a similar outcome via an alternative and more explicitly priced route (e.g. the costs of manual pollination of plants as a proxy for the value of insect pollination).

Box 1: Public appreciation of environmentally and socially beneficial outcomes (ESBOs) delivered by forests in Slovenia does not systematically translate into willingness to pay.

In Slovenia the concept of 'forest functions' (mainly nature preservation, environmental protection and biodiversity) is a principle embedded in policies since 1970s. It requires the sustainable management of forest resources. Since this has been the case for over four decades in Slovenia, the provision of a range of public goods and ecosystem services by the forestry sector is largely perceived by Slovenian society to be a guaranteed outcome of such activities and therefore does not result in any willingness to pay for it by the population.

Estimating the economic and monetary value attributed to environmentally and socially beneficial outcomes is a very challenging exercise[24]. Numerous such studies have been conducted, particularly within the context of cost-benefit evaluations to inform new development in rural areas, and in respect of long-term investment decisions based partly on their anticipated environmental and social benefits e.g. afforestation. Nevertheless, as noted by Dwyer *et al* (2015), critiques of these studies and methods also abound, as all these valuation methods have limitations (Simpson R. D., 2011; Mollard A., 2003; 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).

Key issues relating to the monetary valuation methods of ESBOs emerging from early stages of the PEGASUS project include the following:

- *Value is subjective, often context-dependent and often disputed*. It cannot be disconnected from individual or collective choice which in turn is socially and culturally constructed (Silvis and van der Heide, 2013). For example, the Italian workshop found that in Italy and other Mediterranean countries, society tends to value ESBOs more where they are strongly related to cultural and rural heritage, as well as traditional farming systems.
- *The tangibility and visibility of ESBOs have an impact on the extent to which they are valued by society* (the issue of use/non-use values or intermediate/final goods and services). Some environmental and social goods and services are intermediate (or supporting/indirect) goods and services (e.g. soil formation or nutrient cycling) and as such they do not impact on society's wellbeing as directly as final goods and services do (e.g. food production or clean water). Levels of societal awareness and appreciation of these indirect benefits may be lower for this reason and consequently distort estimates of value.
- *Interdependency of environmental and social benefits*: different goods and services can deliver the same benefit to society, which poses additional difficulties as to how to value them – with a risk of double counting, e.g. nutrient cycling and water flow

[24] Another Horizon 2020 project, called PROVIDE, funded under the same call for projects is focusing on ecosystem services monetary valuation.

regulation both result in clean, usable drinking water for society but we cannot determine the relative contribution of each good or service or human action to any specific benefit for society (Simpson R. D., 2011 and Bateman *et al,* 2011).

For these reasons, putting a focus on the monetary valuation of ESBOs from farming and forestry has not been chosen as the most appropriate way to address the aims of PEGASUS. The choice has been made not to focus on trying to determine the precise level of societal demand for these beneficial outcomes. Rather, PEGASUS will explore the forms of expression of public demand through the range of different values associated with ESBOs in the case studies. Subsequently it will seek to understand how best these might be strengthened in the future (e.g. via policy, via adding value to products, via education/training, etc., whilst acknowledging the multi-functional nature of farming and forestry producing ESBOs alongside food, feed, fibre and timber.

The cascading valorisation diagram indicates that awareness and appreciation as an expression of societal demand does not necessarily result in economic demand and/or pricing, neither does it always become reflected in alternative value recognition responses (e.g. in legislation or collective obligation through governance). In other words, in the diagram the third step of the valorisation chain is a 'weak link' where 'market failure' or failures of other types of response occur, leading to under-provision of ESBOs by suppliers in farming and forestry.

6.3 Stimulating supply and demand for environmental and social benefits

To address the under-provision of environmentally and socially beneficial outcomes and failures of response whether through policy/institutional mechanisms or the market, a range of possible actions can be identified, such as:

- Raising awareness of the relevant stakeholders and the public (boosting demand);
- Changing regulations, various incentives including through the market, or institutional conditions to create the right enabling environment for enhanced delivery of more environmentally and socially beneficial outcomes (increasing supply and potentially demand as well).

Such actions contribute to greater 'valorising' of public goods and ecosystem services in the sense that they make ESBOs more visible and valuable to the public which in turn should increase the potential for action to be taken to address their under-provision. The focus of PEGASUS is to explore the range of values expressed by society and valorisation approaches that are or could be used and identify these in different farming and forest systems in the case studies, examining how they might be strengthened or even lead to the development of novel 'valorisation' approaches to foster public goods and ecosystem services delivery.

In the EU, various **mechanisms** (public and private) have been developed to enhance the value and appreciation of certain environmentally and socially beneficial outcomes delivered by agriculture and forestry. Different mechanisms were examined in nine PEGASUS partner countries using SWOT[25] analyses, to investigate the 'valorisation' process

[25] Strengths, Weaknesses, Opportunities and Threats

deriving from these mechanisms. Subsequently these were discussed at workshops with national/local policy makers, experts and practitioners.

The mechanisms reviewed can be divided into eight types (broadly classified from purely private to purely public mechanisms), as shown in the list below. Some of these 'valorisation' mechanisms aim to enhance value for society and therefore demand for environmentally and socially beneficial outcomes through the successive steps of the valorisation chain. However, the objectives of many of these mechanisms are inevitably also focussed on enhancing the supply of these outcomes as a means of generating greater appreciation for them and hence greater demand. Their design generally reflects this. For example, raising society's demand for organic products is achieved through the sharing of knowledge and information by organic producers and associations and at the same time, this growing societal demand will raise other suppliers' interest in adopting organic or similar practices. In fact, the more one moves towards the publicly organised mechanisms, the more the focus appears to be on enhancing supply with less emphasis on the demand side.

Private

(i) Private/market-linked mechanisms: speciality consumer products or products in labelling schemes generating value through their capacity to attract a price premium, e.g. PDO/PGI products, organic schemes, sustainability/environmental schemes such as the Forest Stewardship Council FSC, animal welfare schemes, etc., or where economic sectors depend upon and thus partially reflect environmental or cultural goods and services, e.g. tourism/recreational activities.

(ii) Quasi-market instruments e.g. mechanisms to offer public payments to encourage specific provision (e.g. developing standard payment rates or auctions) such as with the agri-environment-climate payments of the CAP for farmers, or influencing provision via conditions/choices in more general public procurement or public subsidies (e.g. patient health budgets supporting care farms)

(iii) Behaviour change among farmers and foresters anticipating economic benefits but instilled by research and knowledge exchange to identify and promote new, more synergistic opportunities from technical and managerial innovation in production systems with wider environmentally and socially beneficial outcomes as well.

(iv) Behaviour change among citizens/consumers through quality information and education to increase awareness, appreciation and ultimately demand for ESBOs and decreasing the occurrence of cases where damaging action is taken arising from positive intentions, e.g. buying local but unsustainable wood products (i.e. produced under a management system that has damaging impacts on ESBO delivery).

(v) Regulations and standards which define property rights so as to place public duties on private actors, e.g. prohibition of certain types of land use or management in sites of specific public value or in respect of certain activities.

(vi) Governance structures enforcing or enabling enhanced delivery of environmentally and socially beneficial outcomes from farming and forestry activities in an area (e.g. partnerships and local institutions such as national or regional park authorities)

(vii) Collective action to provide environmentally and socially beneficial outcomes directly as the primary purpose of farming and forestry activity (e.g. NGO action)

(viii) Non-monetary-related behaviour change among farmers and foresters, encouraged and facilitated by information, education/training and collective peer-support

(ix) Intervention by the state to provide the goods directly through e.g. acquisition of land by the state, of rights via the use of covenants

Public

The SWOT analyses of these mechanisms were not based on an exhaustive literature review. Nonetheless it indicates the relative strengths and weaknesses of a limited selection of these mechanisms in relation to their role in enhancing appreciation and demand of ESBOs. An inventory of a much wider range of policy mechanisms used to encourage both the appreciation and provision of ESBOs in the PEGASUS partner countries is part the focus of WP3 of PEGASUS.

In the **SWOT analyses**, examples of existing mechanisms of various types were investigated in nine countries. These fall under three of the categories identified above:

- Category (i): labelled food products in the Netherlands, Austria, France and Germany; rural tourism in Slovenia and Estonia
- Category (ii): payments for maintenance of an agro-silvo-pastoral system in Portugal; restoration of stonewalls in Estonia; creation of fodder strips in Czech Republic.
- Category (vi): 'Care farming' in the UK.

Nearly all well designed mechanisms have some **strengths** in that they change the conditions under which farmers and foresters operate or raise society's demand which encourage the delivery of certain ESBOs from agriculture and forestry (e.g. through labelling schemes). In some specific situations, the goals established by the 'valorisation' mechanisms were found also to lead to helpful synergistic outcomes, such as encouraging innovation (Netherlands, France), increasing the potential for the rural tourism sector (Estonia, Austria and Slovenia), enabling the continuation of (family) farms (Germany and the Netherlands), encouraging favourable retail strategies (Germany) and increasing public appreciation. However the continued under-provision of environmental and social goods and services in many locations shows that there are limits as to what they have been able to deliver to date.

The literature identifies a number of more general limitations and potential weaknesses of existing mechanisms in relation to their utility in increasing public awareness and appreciation. One set of weaknesses relate to the *spatial and time scales* for the delivery of ESBOs. In terms of spatial issues, the delivery of those ESBOs that are of a more global nature (e.g. carbon sequestration contributing to climate change mitigation) is less visible at the local level with the implication that public appreciation is likely to be less. Similarly, patterns and relationships affecting lead times between the efforts/investments made on the ground and the actual delivery of the environmental and social outcomes can be relatively long and so blur the effort-result sequence. There are also cyclical patterns and relationships affecting the delivery of ESBOs, e.g. the holiday or prime tourism period may be the only temporal window within which economic rewards can be generated from landscape character, the growing vegetative season is the peak for carbon sequestration (Bateman *et al*., 2011). All of these points raise questions about how to estimate the value of these efforts (and also how to set the right level and mode of public or private support).

The issue of trade-offs between ESBOs and the jointness of provision can pose problem in the application of the concept of payment for ecosystem services (PES) in some cases where such schemes single out one ecosystem service rather than following a systems approach that acknowledges the multiple interactions between the delivery of different ESBOs. Nonetheless, single issue PES can also have benefits for example in terms of effectiveness - an issue to be explored further in the case studies). There is growing evidence that deliberative or participative approaches that rely on social processes, including individual, institutional, and societal factors often are better able to identify and valorise the multiple benefits arising from complex systems (Dominati *et al.*, 2010 and Martin-Lopez *et al.,* 2014). Other studies (Morlat *et al.*, 2014; Banaszewska *et al.,* 2013) have also stressed the need for collective contracting and accounting methods as a means of moving towards an enhanced

recognition of the social and environmental values of the range of goods and services delivered by agriculture and forestry.

Even this short introduction to current issues demonstrates that there is **scope for improving** policy and stakeholder actions towards an enhanced valorisation as well as supply of these beneficial outcomes. Some ideas emerging from the ten PEGASUS workshops signal some potentially helpful directions.

These include:

- the potential for a shift towards more result-based incentives to give land managers more ownership and responsibility for the provision of environmentally and socially beneficial outcomes and creating an enabling environment for longer-term behavioural change;
- Investigating alternative business models supporting management systems where economic return are currently low but there is high provision of environmental and social goods and services benefiting society.
- Changes to institutional structures to focus more on the people able to drive and deliver these environmentally and socially beneficial outcomes as well as the promotion of territorially-based entities that are also more respectful of local knowledge and social-cultural aspects. This could include educational actions targeted at citizens/consumers.
- Ensuring that policies and institutions consider how local needs and wider national/EU objectives may be met and jointly delivered.
- Designing incentives in a way that takes account of the importance of avoiding actions that are detrimental to the delivery of environmentally and socially beneficial outcomes, i.e. those practices that weaken the provision of ESBOs in the agriculture and forestry sectors.
- Greater recognition of the synergies and trade-offs between the different beneficial outcomes targeted.
- Reconnecting policies and institutions for agriculture/forestry, together with the environment as well as downstream supply chains for food and timber/wood products (e.g. Lamine, 2015).

In all cases, raising awareness and appreciation among all stakeholders including the general public was a key issue highlighted in the workshop discussions.

Box 2: the French agro-ecology initiative

Since 2010 in France, national policies have been supporting a major initiative to encourage a shift to "agro-ecology" framework in agriculture. The Economic and Environmental Interest Groups ('GIEE'), introduced in 2014 as part of the initiative, enable groups of farmers to jointly develop agro-ecological models on their farms. In September 2015, there were some 103 such groups. The agro-ecology principles seek to promote the enhancement of food/biomass production while delivering more environmentally beneficial outcomes, as part of the objective to achieve sustainable development.

A number of different concepts and mechanism have been put in place within this overarching frame. These include some payment schemes designed to reward provision of desired ecosystem

services associated with agriculture, the creation of multi stakeholder, collective working groups and institutional structures to operate payment schemes and initiatives to internalise the costs and benefits of ESBO delivery. Inspiration has been drawn from established schemes, particularly those involving payment by water companies, such as Volvic for appropriate land management to aid the supply of uncontaminated water.

In conclusion, it has been shown that enhancing societal demand is often an important means of ultimately increasing the provision of environmentally and socially beneficial outcomes associated with agricultural and forest activities. However enhancing demand should be accompanied by the development of appropriate means of securing enhanced supply. Both demand and supply components are challenging to change, and some of the reasons for this include the failure of policy, market and institutional mechanisms to provide adequate incentives (whether economic, legislative, institutional, or behavioural) to farmers, foresters and other land managers to engage in sufficiently meaningful and long-term change. This shortfall applies to incentives developed by both individuals and collectives. Nonetheless, many good examples provide a foundation for PEGASUS research to analyse and inspire new and enhanced approaches for the future. Even at this early stage in the project, ideas for improved mechanisms coming from the national workshops include:

- rethinking the signals sent to land managers through existing public support;
- reconsidering the market and institutional structures in which they operate; and
- taking better account of successful private-led initiatives in exploring the scope and reach of the options available.

7 Translating the conceptual framework into practice

PEGASUS draws on the strengths of the concepts of public goods and ecosystem services to investigate the reasons why there is both undersupply and unmet societal demand for environmentally and socially beneficial outcomes (ESBOs) from agriculture and forestry and to propose new ways to incentivise their delivery by farmers and foresters and/or the cessation of damaging practices. In doing so it explores a social-ecological systems approach.

This report provides the foundation for the work to be carried out in the case studies (WP4) where the way in which land managers (farmers and foresters) can be encouraged to enhance the delivery of environmentally and socially beneficial outcomes (and to reduce practices that actively damage ESBOs) will be analysed in a range of practical cases, primarily at regional level, in different EU countries. It complements the mapping by providing a common base for the environmentally and socially beneficial outcomes to analyse under WP2, as well as the analysis of market and institutional drivers under WP3.

One of the outcomes of the literature reviews and the PEGASUS workshops carried out in this early stage of the work is that any change in farmers and foresters' practices remains highly sensitive to economic and business-related signals and constraints while a range of non-economic considerations are important as well. This simply emphasises the value of taking full account of the preferences, needs, expectations and prevailing cultures of the various individuals and institutions at the centre of land decisions and of their core activity

as land managers in order to secure desired outcomes at the local scale. The importance of examining the joint production of public and private goods and services and seeking a balance in production through synergistic approaches is also underlined. While jointness is widespread, it does not apply in all cases so other models need to be considered in parallel, as do longer term questions about how jointness may develop in future and the types of synergy that may apply.

By bringing the natural and human systems together, the social-ecological system concept provides a systemic and inclusive lens through which to examine farming and forestry activities and dynamics and identify the mechanisms that effectively strengthen the delivery of certain ESBOs. The relevance and robustness of the social-ecological system as a framing concept will be further explored through the case studies with a view to developing a practical toolkit that can operationalise the concept. The case studies will also test the utility of the SES concept in facilitating long-term systemic changes and improving systemic resilience through a better balance of social, environmental and economic outcomes.

Initial work on the linkages between the prevailing managing practices in different farming and forestry systems and the impacts on the delivery of ESBOs indicates that there are many factors in play. Some relationships can be expressed in relatively general terms, distinguishing between the roles of intensive and extensive farming systems for example. Others are more complex and subject to both regional and more case specific variations.

In the case studies, the PEGASUS project will test the soundness of the linkages identified in this review and extend this analysis to the relationships with socially beneficial outcomes delivered by agriculture and forestry. The project will therefore provide a local, case-based understanding of synergies and conflicts in different European regions between the occurrence of ESBOs and management systems, but also other factors impacting this provision, highlighting in each situation what specific mix of mechanisms have led to the establishment of hotspots or cold spots (under-provision) of targeted beneficial outcomes.

The literature review and accompanying analysis of the current state of societal demand indicates that there is unmet societal demand for more provision of environmentally and socially beneficial outcomes from farming and forestry systems. It also concludes that seeking to determine the level of societal demand simply through monetary valuation of ESBOs from farming and forestry is not an efficient way to address the project's aims. The analysis clarified that societal demand for these specific beneficial outcomes alone is generally not a sufficiently powerful lever to trigger a market response (although there are exceptions). In some cases, current institutional, policy/implementation or behavioural and other non-market responses are insufficient as well. To address this under-provision, a range of possible actions can be identified. In broad terms, these aim to (i) raise both public and practitioners' awareness and interest, and (ii) create the right enabling environment for enhanced delivery of more environmentally and socially beneficial outcomes. The initial findings from the examination of selected examples of existing 'valorisation' mechanisms at this stage have shown some shared strengths but also weaknesses, applying to initiatives located in the private and public domains. Further investigation will be carried out in the case studies in WP4.

In the next phases, and particularly in the case studies, the aim of the PEGASUS project will be to explore novel approaches in different domains e.g. institutional settings, market incentives, collective actions/partnerships, new forms of incentive provision and behavioural change, all aiming to encourage more balanced land management decisions (including reducing the occurrence of damaging practices) and to stimulate additional practical actions with environmentally and socially beneficial outcomes. Ultimately, PEGASUS will seek to demonstrate the multiple benefits of the increased provision of environmentally and socially beneficial outcomes alongside economic outcomes derived from balanced decisions in agriculture and forestry.

It is worth noting that a range of policy issues relevant to PEGASUS will continue to be at the top of agenda in Europe, for example in climate policy (through e.g. the pursuit of greater carbon sequestration), the cascading use principles and the circular economy (e.g. nutrient recovery via soils), biodiversity conservation and enhancement (e.g. maintaining a diversity of habitats and species), improved water quality objectives, employment and growth in rural areas, etc. As a result, PEGASUS recommendations may be relevant at several levels of governance and on several themes from the Common Agricultural Policy to national-level forest policies.

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Annex 1: Intended beneficial outcomes from activities in agriculture and forest ecosystems

Intended beneficial outcomes from agriculture and forest ecosystems that are the focus of PEGASUS[26]				
Broad categories of objectives to be achieved:	**Environmentally and socially beneficial outcomes - ESBOs - [and dominant dimension]**	**Description of the beneficial outcome sought**	***Insights from ESS concept*** ***Tells us about the nature of the ESS contributing to the benefit***	***Insights from Public Goods concept*** ***Tells us about whether or not there is a risk that markets alone will not provide an optimal allocation*** ***[private, impure public or pure public characteristics identified in brackets]***
Sustainable and sufficient production of food, timber and energy	1. Food security: Achieving (or maintaining) a sustainable natural resource base to ensure a long term food supply hence security [Economic, social, environmental]	The benefits associated with food security can be: (i) Access to affordable and safe food **--> *not in PEGASUS remit*** (ii) Adequate food supply **--> *not an ESBO*** (iii) Maintenance / increase of a sustainable resource base, as a means to secure the long term capacity of the land to produce food/fibre, etc. **Only the (iii) definition is to be considered relevant for PEGASUS**	*For sustainable resource base (iii) – see ESS involved in all other environmental benefits in this table*	*For sustainable resource base (iii) – see PGs involved in all other environmental outcomes [and their characteristics]*
High water quality and ensuring water availability	2. Water quality: Achieving (or maintaining) good ecological status of surface water and good chemical status of groundwater [Economic, environmental and social]	- Maintenance/increase of areas with surface water of 'good ecological status'*, i.e. with high biological activity in rivers and other water bodies. - Maintenance/increase of areas with surface and groundwater of 'good chemical status'*, i.e. low contamination levels ** Water Framework Directive 2000/60/EC*	*Chemical conditions of freshwaters and salt waters* *Mediation by ecosystems through filtration, sequestration, storage, accumulation of pollutants in freshwaters and salt waters*	*Market does not deliver effectively/automatically and therefore alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome.* *E.g. Water Framework Directive (2000/60/EC) requirements, private initiatives (e.g. water companies), public incentives.* *[Public good characteristics]*

[26] Desired levels of ESBO provision (e.g. maximised or minimised levels) are determined by society's demand.

	3. Water availability: Achieving (or maintaining) a regular supply of water (i.e. avoidance of water scarcity) [Economic, environmental and social]	- Increase / maintenance of sufficient volumes ('quantitative status' - Water Framework Directive 2000/60/EC) of groundwater available for drinking and other purposes - Increase/maintenance of the capacity to ensure regular flows of water supply and discharge (i.e. avoiding water scarcity and discharge peaks)	*Provision of surface and ground water for drinking and non-drinking purposes* *Hydrological cycle and water flow maintenance*	*Market often does not deliver effectively /automatically and therefore alternative mechanisms may need to be put in place to ensure optimal allocation of the resource. E.g. water pricing is in place in some countries; however, pricing frequently only covers the costs of providing the water supply and not the value of water itself. Abstraction licences are required under certain conditions in most MSs.* *[Public good characteristics]*
High air quality	4. Air quality: Achieving (or maintaining) minimised levels of harmful emissions and odour levels [Environmental and social]	- Levels of air pollutants and odours as a minimum to comply with the standards laid down in statutory standards e.g. the Air Quality Directive 2008/50/EC - Improved management of farm resources that lead to harmful emissions and odours - Farm/forestry management to lessen/mitigate pollutants and odour levels found in air	*Partial fit with Atmospheric composition and climate regulation* *Mediation of smell by ecosystems*	*Market does not deliver effectively/automatically and therefore alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome.* *E.g. regulations are already in place (and under review currently) to limit harmful emissions.* *[Public good characteristics]*
Climate change mitigation objectives	5. GHG emissions: Achieving (or maintaining) minimisation of greenhouse gas emissions [Environmental and social]	- Reduction in /minimisation of emissions of methane, nitrous oxide and carbon dioxide from the agriculture and forest sector (from livestock farming, agricultural machinery, fertiliser use as well as land management and land use change)	*Global climate regulation by reduction of greenhouse gas (GHG) concentrations*	*Some private characteristics where actions would also reduce costs in certain cases, e.g. energy efficient machinery. However overall the market does not deliver effectively/automatically and therefore alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome.* *E.g. regulations setting targets for GHG reductions; incentive payments.* *[Public good characteristics]*
	6. Carbon sequestration/storage : Achieving (or maintaining) maximisation of	- Enhancing the storage/removal of carbon from the atmosphere through maintenance / increase of carbon sinks	*Soil formation and composition notably through fixing processes* *Global climate regulation by*	*Some limited private characteristics where carbon stores have an economic value (deep soils, forest biomass). However, in general the market does not deliver effectively/automatically and therefore*

	carbon sequestration and storage [Environmental]		*reduction of greenhouse gas concentrations*	*alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome.* *[Private and public good characteristics]*
Climate change adaptation	7. Fire protection: Achieving (or maintaining) a high level of prevention and minimisation of impacts of potential fires [Environmental and social]	- Reduction/minimisation of risk, magnitude and frequency of fire through prevention measures - Improvement/maximisation of resilience of agriculture and forest land to fire	*Partial fit with Atmospheric composition and climate regulation*	*Private characteristics where the control of the fire risk and the costs of damage inflicted are both incurred by private landholders. But generally, the market does not deliver at the wider scale effectively/ automatically and therefore alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome.* *E.g. incentive payments* *[Private and public good characteristics]*
	8. Flood protection: Achieving (or maintaining) minimisation of impacts of potential floods [Economic, environmental and social] *Flood protection is also tightly linked to water availability through the management of water flows*	- Increasing the water holding capacity of land - Slowing water flow e.g. by maintaining suitable land cover, structure and management to provide natural protection against floods	*Flood protection* *Hydrological cycle and water flow maintenance*	*Market often does not deliver effectively/automatically and therefore alternative mechanisms often need to be put in place to ensure suitable actions are taken to deliver the desired outcome. It is noted that the frequency and severity of flooding is likely to increase with climate change.* *E.g. flood plans (Floods Directive 2007/60/EC), River Basin Management Plans (Water Framework Directive 2000/60/EC).* *[Public good characteristics]*
Healthy, functioning soils	9. Soil functionality: Achieving (or maintaining) good biological and geochemical condition of soils 10. Soil protection: Achieving (or maintaining)	- Maintenance/increase of areas where soils are in good biological and geochemical condition, expressed notably in terms of soil fertility, soil biodiversity, soil nutrient storage capacity and soil structure. As a result, soil is also able to fulfil its functions of weathering, soil formation, decomposition of dead organic material and fixing	*Mediation of mass flows, including mass stabilisation and control of erosion rates and buffering and attenuation of mass flows* *Soil formation and composition, including weathering, decomposition and fixing processes*	*Some private characteristics as it is a private resource and it should be in the private interest of the land manager to sustain healthy soils for long term productivity of the land. However, this is not always the case where short term priorities (or lack of knowledge) override longer term considerations. Therefore the market alone does not deliver effectively/automatically and alternative mechanisms are required to*

	minimisation of soil degradation [Environmental and social] *Soil functionality and protection directly underpin the provision of a number of other objectives: achieving a sustainable resource base for food security, water quality and availability, carbon sequestration and biodiversity.*	nutrients. - Avoidance of soil degradation, including erosion, floods and landslides, salinisation, contamination, compaction and sealing, *(c.f. EU Soil Thematic Strategy)*		*ensure suitable actions are taken to deliver the desired outcome.* *E.g. incentive payments, conditions on land management payments, possibilities of carbon markets.* *[Private and public good characteristics]*
High levels of biodiversity	11. Species and habitats: Achieving (or maintaining) the presence of diverse and sufficiently plentiful species and habitats (ecological diversity) 12. Pollination: Achieving (or maintaining) high levels of pollination [Environmental] *Given the importance of the role of pollinators in agriculture (and forestry) activities, this is considered under a separate sub-set within biodiversity*	- Maintenance/increase in abundance and diversity of species and habitats that comprise biodiversity on farm and forest land, including high levels of crop and livestock genetic diversity (in line with the Birds Directive 2009/147/EC and the Habitats Directive 92/43/EEC) - Maintenance / increase in diversity and abundance of plants that are beneficial to (both wildlife and crop) pollinators - Increase in the abundance and distribution of (both wildlife and crop) pollinators	*Lifecycle maintenance, habitat protection and gene pool protection, notably through pollination and seed dispersal*	*Market does not deliver effectively/automatically and therefore alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome.* *About pollination, there is some potential to leverage action in the private sector as without crop pollination, productivity can be severely impacted. In spite of this, there is currently no wide-scale incentive for private actors benefiting from pollination to protect and enhance its supply. For wildlife pollination only, the market does not deliver.* *Predominantly [Public good characteristics]*

	13. Biological pest and disease control through biodiversity: achieving (or maintaining) high levels of biological pest and disease prevention and minimisation of the impacts of potential outbreaks using biodiversity [Environmental]	- Maintenance / increase of and use of a diverse biodiversity base for pest and disease biological control, i.e. to reduce the risk of incidence and/or to contain the impacts of pest and disease outbreaks	*Pest and disease control*	*Strong private characteristics where this is within the land managers' control. However, the market does not deliver effectively/automatically and therefore alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome (i.e. mainly biological control using biodiversity).* *It is noted that in many cases very high levels of pest and disease controls exist, but without using biodiversity as a control tool.* *[Private and public good characteristics]*
Protecting landscape character and cultural heritage	14. Landscape character and cultural heritage: maintaining or restoring a high level of landscape character and cultural heritage [Social and environmental]	- Maintenance of heterogeneous and locally distinctive cultural, archaeological and built heritage, as well as the ecological infrastructure that contributes to the character of the agricultural, forestry and rural landscape in a particular location.	*Spiritual, symbolic and other interactions with biota, ecosystems, and landscapes (environmental settings)*	*Market does not deliver effectively/ automatically and therefore alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome.* *[Public good characteristics]*
Public recreation, education and health	15. Outdoor recreation: Achieving (or maintaining) a good level of public access to the countryside to ensure public outdoor recreation and enjoyment [Social]	- Maintenance/increase of access to the countryside and opportunities for sustainable outdoor recreation, including green tourism opportunities, on agriculture and forest land.	*Physical use and intellectual/representative interactions with landscapes in different environmental settings* *Experiential use of plants, animals and landscapes in different environmental settings*	*Some private characteristics, particularly where access can be controlled (it is noted that paid access may run counter to a social ideal and it is income-discriminatory). However, where access is open to all, the market does not deliver effectively/automatically and therefore alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome.* *[Private and public good characteristics]*

	16. Educational activities: Achieving (or maintaining) a good level of educational and demonstration activities in relation to farming and forestry [Social]	- Enhanced and increased availability of education and demonstration activities on farms and in woodlands	*Physical use and intellectual/representative interactions with landscapes in different environmental settings* *Experiential use of plants, animals and landscapes in different environmental settings*	*Some private characteristics where land managers are economically rewarded for the benefits they provide to those being educated and more generally to society. However, these activities are often not economically sustainable without some form of support and therefore alternative mechanisms need to be put in place to incentivise the actions required to deliver the desired outcome.* *[Private and public good characteristics]*
	17. Health and social inclusion: Achieving (or maintaining) an appropriate level of therapeutic /social rehabilitation activities in relation to farming and forestry [Social]	- Increased use of farming and forest systems to provide therapeutic benefits to improve health, wellbeing and social rehabilitation	*Physical use and intellectual/representative interactions with landscapes in different environmental settings* *Experiential use of plants, animals and landscapes in different environmental settings*	*Some private characteristics where land managers are economically rewarded for the benefits they provide to the patient(s) and more generally to society. However, the market in this area is not well developed and therefore does not deliver automatically. Alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome.* *E.g. Care Farms / Natural Health Service* *[Private and public good characteristics]*
High levels of farm animal welfare	18. Farm animal welfare: achieving (or maintaining) the implementation of high farm animal welfare practices on farms [Social and environmental]	- Good animal husbandry practices to ensure the avoidance of unnecessary suffering or injury to animals - Access to appropriate living conditions to address animals' physiological and behavioural needs	*Not directly influenced by natural processes*	*Market does not deliver effectively/ automatically and therefore alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome.* *E.g. mandatory standards have been put in place at EU level, creation of new markets via certification schemes.* *[Private and public good characteristics]*
Preserving and enhancing rural vitality	19. Rural vitality: Achieving (or maintaining) active and socially resilient rural communities	- Social viability of rural populations through adequate employment and incomes - Sense of community among the rural population - High levels of social capital, trust and	*Natural processes are not the primary determinant of rural vitality but may be relevant in some cases, e.g. areas prone to flooding*	*Markets have traditionally helped to support and sustain rural communities but in modern developed economies, the market trends may have significant positive or negative impacts upon vitality. The fact that markets do not incorporate social impacts*

	[Social]	cooperation between people (including the promotion of equal opportunity and status for men and women) - Embodying, maintaining and sustaining rich cultural practices, knowledge and traditions - Sense of 'place' and 'territoire'		*suggests that markets do not delivery effectively/automatically and therefore alternative mechanisms need to be put in place to ensure suitable actions are taken to deliver the desired outcome.* *[Public good characteristics]*