QUESSA

Quantification of ecological services for sustainable agriculture

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Report on the perception of benefits of selected ecosystem services

Bálint Balázs, Györgyi Bela, Eszter Kelemen, György Pataki
Environmental Social Science Research Group (ESSRG)

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EXECUTIVE SUMMARY

Farmers as primary land users have the most power to interact with the land. Therefore, understanding *farmers' perception of ecosystem services* or ESs through farmers' eyes is of primary importance: their assessments of ESs and their ideas about the possibilities of maintenance will be crucial for land management decisions. This comparative analysis presents how farmers understand the benefits and non-monetary value of on-farm ESs provided by SNHs in main cropping systems (arable, orchard, vegetable and vines) across four European agro-climatic zones in 8 European countries (the UK, Germany, France, Netherlands, Italy, Switzerland, Estonia and Hungary).

Our methodology relied on previous successful engagements with farmers in focus group discussions with a special emphasis on their perceptions on local ESs, as well as what kind of values they attribute to ESs, and how they understand benefits derived. Evaluation of private and public economic benefits and non-monetary value of selected ecological services requires special socio-economic expertise and moderation/communication skills to be successfully delivered in the selected field studies. Therefore, ESSRG provided the case study partners with appropriate standardised methods (semi-structured interviewing, focus groups with farmers, mind-mapping,) to assess farmers' valuation on-farm ecosystem services provided by semi-natural habitats in the case study areas.

We recorded rich and complex set of perceptions about ESs, linked to multiple attitudes and values. Some (e.g. directly economic) aspects of ESs are frequently considered; other cultural or holistic aspects are not at all mentioned. Case studies were heterogeneous according to farmers' knowledge and belief system which influence their perceptions and understanding of ESs and in this sense well-represent the heterogeneity of farming in the EU. The mind-mapping exercise produced a comprehensive and detailed set of farmers' perceptions of most important local ESs. Perceptions are strongly embedded in the agricultural context; less abstract and more emotion-based, connected to everyday farming lives. It shows that farmers normally do not think out of their agricultural contexts. Essentially, the analysis on the interrelatedness of ESs shows that farmers perceive many interrelations with a focus on economic ESs. In fact, farmers recognise that their agricultural practices have a direct impact on ESs and ESs are calculated in their farming decisions.

Attitudes are ambivalent: they usually build on personal feelings and ethical considerations and at the same time use rational economic arguments. Farmers appreciated ESs in multiple ways (e.g. enjoying aesthetics and sense of place, benefiting from ESs, etc.) and valued it against the harm caused by pests, diseases and weeds (an indication of their success as agriculturalists). Positive attitudes typically go for yield and associated ESs including pollination; whereas negative attitudes are recorded towards Functional Biodiversity. Farmers have their own personal and ethical considerations, but these become *dissonant with economic rationale* and capacities in maintaining the farm. As a result, farming ideals and the real world requirements are often in conflict.

What constitutes ES benefit is very much *context-dependent*: ESs have different relative values according to the ecological and social conditions of a given case study setting. In essence, the economic are most appealing in farming. The perceived economic benefits are mostly related to farm management practices (especially how ESs relate to farm economics) and farmers' livelihood and identity as „Good Farmers".

As a most important insight from these group discussions, it became clear that the concept of ESs is very well received in a given local contexts of farming. The valuation exercise also highlighted that the concept of ES is reinterpreted when farmers are involved in the discussions on the local scale. Therefore, understanding farmers' perceptions is crucial to invite them to maintain ESs. Furthermore, generating local level social learning processes (through extension and local study/action groups) can be as much important as supportive policies and subsidy schemes to shape the understanding of ESs. The exercise also pointed to the limits of monetary valuation in ES valuation, as they restrict benefits to economics which are seemingly important for maintaining the farm enterprise but less as an ideal for agriculturalists. Farmers mention 'yields' as the most important as this is the main success criteria represented by the CAP towards farming – however, according to farmers, this is problematic as yields are not equal with the money gained in exchange.

The farmer of the future needs to be encouraged to re-define his/her role to 'I am a photosynthesis manager and an ecosystem service provider'.
(Sandhu and Wratten, 2013. p.10.)

INTRODUCTION

This report (D3.4) gives a detailed overview of the non-monetary valuation of ESs carried out in 8 European countries (UK, Germany, France, Netherlands, Italy, Switzerland, Estonia and Hungary) and provides a comparative analysis of the results. The report presents how farmers understand the benefits provided by SNHs. It summarises Task 3.7 Economic benefits and non-monetary value of ES and Task 3.8 Socio-economic importance of ES as performed by FDEA-ART in Switzerland, GWCT in UK, BXSCAGRO in France, DLO in the Netherlands, EULS in Estonia, UKL in Germany, SZIE in Hungary and SSSA in Italy in the month of 13-42 of the Quessa project. It is relying on the WP3 case studies as conducted in main cropping systems (arable, orchard, vegetable and vines) across four European agro-climatic zones to investigate how farmers value on-farm ecosystem services provided by semi-natural habitats.
Our methodology relied on previous successful engagements with farmers in focus group discussions with a special emphasis on their particular perceptions on local ESs, as well as what kind of values they attribute to ESs, and how they understand benefits derived. Evaluation of private and public economic benefits and non-monetary value of selected ecological services requires special socio-economic expertise and moderation/communication skills to be successfully delivered in the selected field studies. Therefore, ESSRG provided the case study partners with appropriate standardised methods (semi-structured interviewing and focus groups with farmers) to assess farmers' valuation on-farm ecosystem services provided by semi-natural habitats in the case study areas.
We identified key issues for farmers to adopt semi-natural habitats. Our results focus on how farmers capture their own reality in conceptual terms:

- How farmers perceive the ES concept: what are their aspirations and appreciation of ESs on their farms provided by SNHs,
- How farmers understand economic benefits and non-monetary values they obtain from ecosystems: how farmers interpret and argue for or against the economic benefits and non-monetary value of ESs on their farms provided by SNHs;
- How perceptions on the value of ESs are related to farming philosophy and agricultural management practices.

The valuation exercise is a core of the QuESSA project as farmers are regarded as primary land users that have the most power to interact with the land. Therefore, understanding *farmers' perception of ecosystem services* or ESs through farmers' eyes is of primary importance: their assessments of ESs and their ideas about the possibilities of maintenance will be crucial for land management decisions.

THEORETICAL BACKGROUND

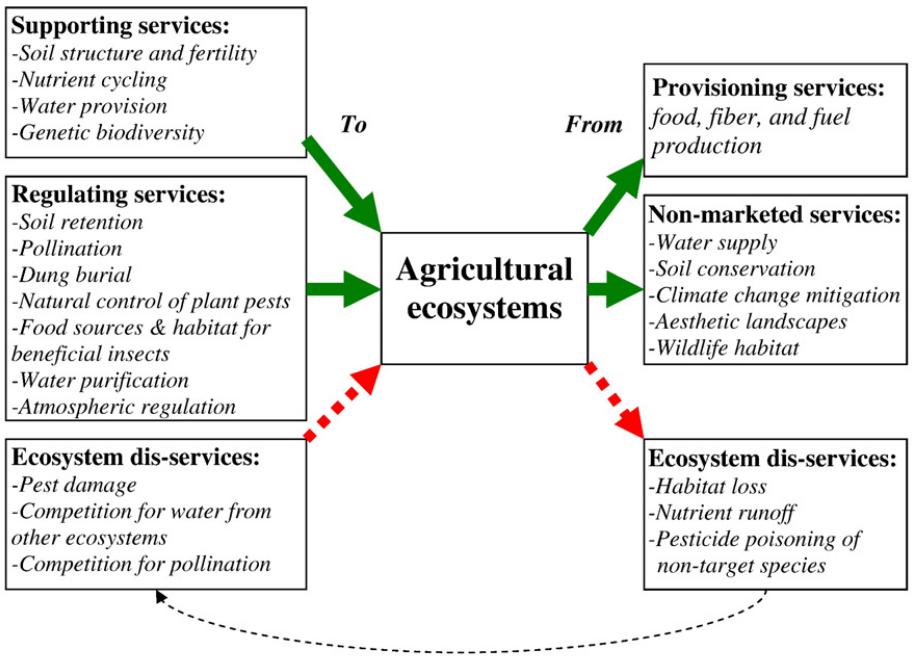
The most widely used **definition of ecosystem services** (ESs) in the Millennium Ecosystem Assessment (MEA) refers to all those tangible and intangible benefits (goods and services) that natural and human-modified ecosystems provide to society. The MEA classification extends to four groups of flow of services: supporting services, such as nutrient cycling and soil formation and fertility; regulating services, such as pest and pathogen control, crop pollination, climate regulation, and water purification; provisioning services, such as food, fibre, fuel, and water; and cultural services, such as education, recreation, and aesthetic value (MEA 2005). Many regards such definition of ESs as lacking clarity and consensus, or having limited operational value (Haines-Young and Potschin 2010, Nahlik et al. 2012, Lele et al. 2013). Norgaard (2010) further argues that the ES concept is insufficient to approach the ecological, economic, and political complexities of the challenges we face and will have potentially damaging consequences and suggest to retain the ecosystem services approach only as part of a larger solution (Norgaard 2010). Silvertown (2015) also criticised the ES concept as being too anthropocentric and having an inherent tendency to stop adherents from recognising alternative approaches.

In contrast to the continuous definition debates (about how to reduce complexity of human nature interrelations) several ES frameworks have been developed to concentrate transdisciplinary research with different foci on management, conservation, policy or valuation (Fisher et al 2009, Harrison 2009, de Groot et al. 2010, Duru et al 2015). Similarly, much research has focussed on the **valuation of ESs**, where the meaning of "value" is most often translated as monetary value. The values attached to ESs through monetary valuation are not necessarily correlated with the preferences of the stakeholders that would be affected by the decisions concerning those services. This may be especially true for the preferences on those ecosystem services that people are not used to expressing in monetary terms and have non-marketable social values such as e.g. cultural or aesthetic significance (Haines-Young and Potschin 2012). Another important shortcoming is that these monetary valuation methods stage assessments as aggregates of individual values (Wilson and Howarth, 2002), whereas values given to different components of ecosystem services are incommensurable and cannot be aggregated (Martínez-Alier, 2002). Therefore, per Baveye et al (2013 and also 2016) monetary valuation (monetization of ESs) is less attractive as it is unclear how markets could manage optimal allocation. Kumar and Kumar (2008) ask for more comprehensive ways of valuation because "when we focus on cultural, memory and linguistic variables we are appraising *not only the intrinsic value of ESs, but also their effects on human health or social structures, their aesthetic contributions, and their significance for future generations*" (O'Hara, 1996, cited by Kumar and Kumar, 2008, p. 814).

Non-monetary valuation approach involves stakeholders in the selection and valuation of ESs can provide alternatives to the shortcomings of economic valuations described above. On the one hand, the outcome of the assessment is likely to have wider social support. On the other hand, such methods provide local actors with the opportunity to learn about their environment and attribute values that are meaningful in the social context by moving away from the expert-based framing and valuation approaches. In sum, non-monetary valuations rely on a more comprehensive valuation as they incorporate not only the intrinsic value of ecosystem services but also their effects on human well-being (Kumar and Kumar, 2008). Even in situations where hypothetic market valuation is supposed to be an appropriate method, studies prove that beside egoistic and selfish altruistic motives (closely related to the view of individual rationality), biosphere motives rooted in ethical considerations shape willingness to pay considerably (Spash, 2000, 2006; Martín-López et al., 2007). Since most ESs is a public good or common pool resource, their allocation influences people from different social layers and hence raises the question of social equity. Wilson and Howarth (2002) argue that *social equity goals can only be achieved if group based, discursive methods are used for the valuation of and the decision upon ecosystem services*. However, even in such processes representation of the social powerless, future generations or non-humans raises normative and ethical questions (O'Neill, 2001).

The complex **interrelatedness of ESs and agroecosystems** have been analysed through various ways, such as e.g. how agroecosystems provide ESs as outputs, or how agroecosystems require and benefit from ESs from natural ecosystems as inputs on various scales; or how ESs are affected by other ESs generated by agricultural practices (Stallman 2011). Relying on ESs provided by natural ecosystems the agro- ecosystems are essential to human wellbeing and for the provision of a variety of other ESs and disservices (DSs). Agroecosystems are regarded as distinct kind of service-providing ecosystems with tremendous variation globally. Agro-ecosystems offer good chance of increasing ESs: dependent on the farming practices agroecosystems are responsible for highly variable assortment and quantity of ecosystem services as recognized by the MEA, and The Economics of Ecosystems and Biodiversity (TEEB); and recently the Intergovernmental Platform on Biodiversity and Ecosystem Services - IPBES (Swinton et al. 2007, De Groot et al 2010; Lescourret et al. 2015). Globally agro-ecosystems face a controversial challenge: increasing yields to feed a growing global population and meanwhile reducing the negative impact of farming systems on the environment. In the ES framework, this means that agricultural management practices increase provisioning ecosystem services often at the expense of supporting, regulating and cultural ecosystem services. Furthermore, farmers' incentives encourage short-term commodity production for the market at the expense of ecosystem services that benefit the public. Therefore, supporting and regulating (and to some extent cultural) ecosystem services are declining because of a complex social trap, the "tragedy of ecosystem services," which results in the underprovision of ESs and their retreat into non-human-dominated ecosystem districts (Lant et al. 2008). ES perspective can help the agricultural management practices to increase the sustainability of agroecosystems and decrease the environmental harms from intensive agriculture (Stallman 2011). **Farmers are the largest group of ecosystem managers** and stewards of over half of Europe's territory (Jackson et al. 2010) as their management practices directly affect the flow of ecosystem services. They have a sophisticated sense of ESs and can provide key information about potentials, essentiality and complexity of ESs (Sutherland et al. 2014). Farmers benefit from regulating ecosystem services (pollination, pest control,) whereas other stakeholders benefit mostly through provisioning services (food production, water quality protection and climate regulation). Management practices also influence the potential for disservices from agriculture or in fact can also ameliorate many of the negative impacts of agriculture, while largely maintaining provisioning services (Dale and Polasky, 2007). Clearly, farmers have a special stake in the good management of ESs, as ESs/EDs shape their agricultural productivity and in turn, EDs affect agricultural inputs (see Figure 1 based on Zhang et al. 2007).

Figure 1. What is at stake for farmers in managing ESs
(Zhang et al. 2007)



Feedback effect of dis-services from agriculture to agricultural input (e.g., removal of natural enemy habitat can encourage pest outbreaks)

As for scale, Zhang et al. (2007) analysed farmers' interest in managing ESs. Field- and farm-scale benefits create a direct incentive for farmers whereas higher scale (landscape, region, global) benefits are likely to accumulate at other stakeholders, including other farmers, in addition to the farmer providing the resource. The table below summarises the major actors and scales of provision.

Table 1. ES scales and actors

(Zhang et al. 2007)

ES or EDS	Field [a]	Farm [b]	Landscape [c]	Region/globe [d]
Services				
Soil fertility and formation, nutrient cycling	Microbes; invertebrate communities; legumes	Vegetation cover		
Soil retention	Cover crops	Cover crops	Riparian vegetation; floodplain	Vegetation cover in watershed
Pollination	Ground-nesting bees	Bees; other pollinating animals	Insects; other pollinating animals	
Pest control	Predators and parasitoids (*e.g.*, spiders, wasps)	Predators and parasitoids (*e.g.*, spiders, wasps, birds, bats)		
Water provision and purification		Vegetation around drainages and ponds	Vegetation cover in watershed	Vegetation cover in watershed
Genetic diversity	Crop diversity for pest and disease resistance			Wild varieties
Climate regulation	Vegetation influencing microclimate (*e.g.* agroforestry)	Vegetation influencing microclimate	Vegetation influencing stability of local climate; amount of precipitation; temperature	Vegetation and soils for carbon sequestration and storage
Dis-services				
Pest damage	Insects; snails; birds; mammals; fungi; bacteria, viruses; weeds	Insects; snails; birds; mammals; fungi; bacteria, viruses; weeds	Insects; snails; birds; mammals; range weeds	
Competition for water from other ecosystems	Weeds	Vegetation cover near drainage ditches	Vegetation cover in watershed	Vegetation cover in watershed
Competition for pollination services	Flowering weeds	Flowering weeds	Flowering plants in watershed	

[a] Services provided from within agriculture fields themselves.
[b] Services provided from farm property, but not necessarily in active fields themselves.
[c] Services provided from landscape surrounding typical farms, not from farmer's property.
[d] Services provided from broader region or globe.

Therefore, ES-friendly agricultural management practices can be best incentivised at the landscape scale (Goldman et al. 2007) Stallman (2011) analysed various ways how incentives could contribute to ES-friendly management. Demarcation of *ecosystem service districts* by legal power have the highest transaction costs and requires relative homogeneity in the landscape. *Cooperation bonus* for farmers

is a monetary incentive to create or maintain jointly a landscape configuration. *Entrepreneur incentive* invites landowners to create their own landscape designs for ES-rich farming systems (Stallman 2011). Managing for ecosystem services also creates a variety of trade-offs (Elmquist et al, 2010.; Kovacs et al 2015). In fact, farmers also perceive trade-offs especially in terms of who benefits - between beneficiaries of higher yields vs the provision of ecosystem services to society. Such perceptions can be well investigated through the concept of ecosystem services to point out private and public benefits and values that connect to the agricultural landscapes. Still, the literature on farmers' values of ecosystem services is limited, with clearly a research gap in understanding farmers' perceptions to ESs (Smith and Sullivan 2014).

METHODOLOGY AND FOCUS OF COMPARATIVE STUDY

QUESSA's focus is to assess farmers' perceptions and knowledge of the importance/relevance of ecosystem services in SNHs (biological control, pollination, soil conservation) for production. SNHs are integral parts of the farmed landscape and being the main source of biodiversity often supported by the EU agri-environmental schemes (Holland et al. 2016). SNHs have a special role as key organisms (e.g. invertebrates) that provide services do not inhabit the agricultural field themselves but live in the surrounding landscape or move between natural habitats. In fact, the existence of SNHs on farms is important causal variables explaining farmers' dispositions toward conservation. Therefore, maintaining SNHs play a role in pushing farmers towards participation in environmental farming schemes (Wilson & Howarth 2002).

Building on the insights from the BIOBIO project (Kelemen et al. 2013) for the purposes of QUESSA we chose an interpretative (hermeneutical) approach, a non-monetary valuation through focus groups to investigate the perceptions of farmers as primary ecosystem managers and what shapes their perception. Our methodology followed a discourse-based qualitative research design allowing interactions between participants to form their opinions and encourage a collective learning process. The main aim is to understand how participants conceptualise a scientific term with their own words and concepts; and how values are assigned to it.

The non-monetary valuation approach was part of the field studies to give more emphasis on farmers' perceptions on local ESs through SNHs and their understanding of the derived benefits. Non-monetary methods can grasp how local farmers perceive ESs. A wide range of social scientific research methods available for the non-monetary valuation of ecosystem services per the time and expertise needed. Simple qualitative and semi-quantitative social scientific methods and participatory methods can be equally used and combined with decision analysis tools. In the QUESSA project, we provided tools for scientists from many different disciplines (esp. from natural sciences) without a priori expertise in non-monetary valuation methods. The main purpose of non-monetary valuation is to *enhance the project's social relevance and farmers' engagement with research*. Previous research clearly shows that local farmers are not always aware of ecosystem services (Buijs et al., 2008). Non-monetary valuation in QUESSA provided new results about how farmers think about ecosystem services and what knowledge needs they have about this topic. Interviews and group discussions used in non-monetary valuation focus on the personal needs and views of farmers and therefore help to understand the intrinsic values of ecosystem services from their point of view. We expect that farmers recognise the results as their own and socially more relevant.

Some advantages of non-monetary valuation can be summarised as follows:

- The valuation process considers the full picture of different well-being dimensions (including e.g. material, physical, social, spiritual aspects) that are positively affected by ESs, thus the results reflect the aspects of individual and community well-being as well as the moral aspects of managing nature held by the society.
- The result of the valuation (deliberated arguments) reflects the plurality and incommensurability of values attributed to ESs which is usually left in shadow when mainstream monetary valuation methods are used.
- The results of the valuation can contribute to decision-making processes with useful information on multiple value domains (i.e. social-cultural, ethical and spiritual values in addition to the total economic value concept).
- The process of valuation allows for eliciting the knowledge, opinion, feelings and beliefs of local farmers in relation to ESs, helps identify knowledge gaps, and supports learning about nature.
- The process of valuation support trust building and networking between scientists and farmers and/or among farmers themselves.

Based on the literature and the BIOBIO project (Kelemen et al. 2013) where most consortium partners cooperated we established five working hypotheses for exploring the local understandings of ESs (H1, H2, H3) and the perceived value of ESs (H4, H5):

- H1: on the difference between scientific and lay definitions - There are no significant differences between the farmers' understanding of ES and the scientifically based definition of ES.
- H2: on the difference of organic vs conventional farming systems - Organic / low-input farmers have a more complex understanding (more solid knowledge) of ESs than conventional farmers.
- H3: on the common points in understanding - During the focus group discussions it is possible to develop a common understanding – acceptable for both local stakeholders and scientists – of ESs.
- H4: on the appreciation of economic vs non-economic values - Conventional farmers acknowledge more those benefits of ESs which can be realised in monetary terms (economic benefits), while organic / low-input farmers acknowledge more the indirect (non-economic) benefits of ESs.
- H5: on farmers' perception of benefits - The more local the level of assessment is the more benefits of ESs participants can perceive.

Data collection

The data collection aimed at testing the above hypotheses mainly through focus group discussions. As an additional source of information in most case studies we collected preliminary data from farmer interviews on how they appreciate the landscape, and nature's values, and farming. Our research methods were explorative and aimed at testing this approach to transdisciplinary assessment by helping ecologists and field researchers of ESs to engage with farmers. Perceptions of the value of ecosystem services were assessed based on interviews (if available) and focus groups. For the purposes of QuESSA, we used focus group as the main data collection method. Based on the literature focus group is the most valued method to collect basic data and at the same time provide an occasion for participants (researchers and farmers) to listen to each other's opinion, and form thoughts together on the issue under investigation. Focus groups are therefore also useful to understand the process how participants conceptualise a scientific term with their own words and concepts. As the focus groups run in different contexts and participating researchers had slightly different scientific and methodological background, we put a strong emphasis on establishing a common ground for the methods and techniques to apply (this is also required to make the data comparable). Thus, we run a training and scientific review meeting in November 2013 to provide partners with theoretical and methodological input for the non-monetary valuation of semi-natural habitats (SNH) and agroecosystems. The training modules followed the three chapters of the Training manual. Chapter I (Theory and Method of NMV) presents the theoretical and methodological background of the valuation process and the non-monetary assessment approach. Chapter II (The QUESSA Valuation Process and Tools) describes the methods we use: ranking exercises in questionnaires, interviews, focus groups, qualitative content analysis and the KIPA technique (a tool for multi-criteria analysis). Chapter III (Sheet for the QUESSA NMV) provides sheets for the valuation exercise with a detailed guideline for each tool. It contains all necessary materials partners need to carry out during the valuation exercise. The training extended to qualitative methods (interviews and focus groups with local farmers) that can identify the non-monetary value of selected ecological services in the case study regions; moderation/communication skills to perform the assessment autonomously and prepare a case study summary. The methods have been demonstrated via interactive exercises.
The data gathering strategy extended to a purpose-driven sampling inviting some farmers from the case study regions if ESs have been monitored on their farm. This caused unintended distortions, and therefore group discussions were not necessarily representative of the case study region. Typically,

the focus group participants were those farmers who had already been involved in the case studies through the fieldwork coordinators, had some interest in the research topic as the research in some way or another had already raised their awareness. Furthermore, the small sample size restricted the scope of generalisations. Still, these farmers were similar in a sense that they have the most to lose and some power to influence ESs in SNHs and they also directly experience ESs during their daily practices in their local contexts. Farmers knowledge and perceptions can differ in many ways from that of other social groups (e.g. non-agriculturalists): some are more familiar with the ES concept, and can easily relate to their understanding of good farming, others feel uneasy to relate ES to agricultural fields. In each case study area, the invited farmers are well-embedded into the same socio-cultural context especially as they farm and live there; therefore, any bias stemming from the local context can be minimised. Most focus groups aimed at involving non-QuESSA field farmers and invited non-conventional groups of farmers as well.
Interviews consisted of an introductory conversation of the history of the farm and farming practices, changes in the landscape over time. This created an additional source of background information about farmers' way of thinking. Focus groups have been organised lasting for 1-2 hours in each case study area to explore how a group of farmers farming in the same village or landscape scale assess the benefits of SNHs as a group. The group discussions were moderated by researchers who posed questions and paid attention to the group dynamics and facilitated the discussion within the group. Group dynamics and interactions among the participants were important to listen to each other's' opinion and form thoughts together. During the focus groups, a photo elicitation exercise helped to visualise ESs to establish a common ground for the valuation of ESs through pictures and to further explore the benefits of SNHs they are aware of. Farmers' conceptualisations have been mapped to discover and understand the different meanings farmers attach to ESs and visualise the logics of the conceptualisation and reach „collective understanding". Discussions also pointed out the main values that farmers attached to ESs in farming.

The focus groups followed the same guideline in each case study:

- Introductory round: we asked participants to briefly introduce themselves with their names, and with a few words about their farm.
- Warm-up: farmers have been asked about their personal impressions of the local landscape and why they like farming and living there.
- Visual exercise - mind mapping (Figure 2): based on the preliminary interviews the most important 5 ESs have been chosen by the researcher, and farmers have drawn logical connections between concepts to symbolise the relations between the connecting concepts.

Figure 2. Participants engaged in the mind-mapping exercise in the UK case

- Moderated discussion: Then they were asked to relate these words and concepts to the pictures of ESs on the table. Several questions followed: Under what conditions it is possible to maintain these ESs on the long run? How do these ESs depend on each other? How do these ESs contribute to the wellbeing of the local community? What are their positive and or negative impacts? Finally, farmers were asked about SNHs and their value.

- Closing: Farmers were asked about final thoughts, and thanked for sharing an opinion with researchers.

Data analysis

To compare the results across case study areas and at the same time retain the maximum for special socio-cultural and economic context-dependency of data (unique perceptions of local farmers and what shapes their perceptions) we chose a **qualitative content analysis approach** (Kohlbacher 2006, Elo and Kyngäs 2008). During the qualitative content analysis, the perceptions on ecosystem services have been coded deductively with predefined code categories for comparison and some emerging concepts (Patton 2002). The process of deductive content analysis builds upon the idea that a coding agenda is developed from theory and previous results, which gives explicit definitions of each category and determines when and how a text passage can be coded with a category (Mayring, 2000). Then, the researcher works through the text by using this coding agenda, and simply looks up the codes in the text which were defined in the agenda paying also attention to the context of the codes. If there are considerably long passages of the text which cannot be coded according to the agenda but have useful (interesting) content, emergent codes and categories can be defined and added to the coding agenda (revision of categories).
Coding started with the transcribed data by reading the text carefully and looking up the predefined codes. During the analysis participating researchers asked for help from each other, shared ideas and improved their process continuously. The reports gathered typical references and explanations about the contextual characteristics of core concepts (Table 2).

Table 2. ES code categories

Key category	Core concepts (codes) related to the category
Interrelatedness of ESs	Mutually supportive, Inter-dependent, In-dependent, Antagonistic,
Relations between ESs and SNHs	Combination of ESs with the occurrence of SNHs
Attitudes to ESs	Positive or negative attitudes
Beneficiaries of ESs	Farmers, Local community, Broader community
Readiness to care for SNHs	Personal interest, Pushed by government regulations

When coding was finished, researchers were asked to fill in the coding agenda with typical references and explanations about the contextual and attitudinal characteristics of the code The patterns and richness of the text produced in the focus groups have been extracted by using this coding agenda (Table 3).

Table 3. Coding Agenda

Cate-gory	Code	Definition	Typical narratives	Who mentions?	Context - knowledge/opinion/ feeling - conflicting or unifying	Frequency

The results of coding and the concept mapping exercise gave the substantial source of information for analysis. Due to time constraints and the different level of experiences of participating researchers

finally, we faced some divergence among cases (not all partners transcribed the preliminary interviews and the focus group discussions).
In sum, as the main concept of QUESSA, the ESs in SNHs tell little to local communities. Therefore, we need to operationalise this concept into lay language and make this scientific concept accessible for local communities. Focus groups have been used to catalyse informal and joyful interaction around the ESs concept and to draw a more complex picture of the links and social embeddedness. Our investigations relied on a deductive content analysis through using a coding agenda to study the transcripts of focus groups.
As for the generalisability of our results we contend that the focus group research is valid mainly for Quessa case study regions, and can be generalised to farmers based on the representativeness of local focus groups). All results emerging from the group dynamics and interactions among farmers or with researchers clearly provide lessons for cooperative, participative research settings in general and especially for the growing body of qualitative non-monetary ES valuation studies. Reliability of this research could be improved by extending the sample and organise more focus groups in each country with more farming systems to discover better the landscape specific features.

RESULTS OF THE COMPARATIVE ANALYSIS

Contexts of focus groups

The focus groups were organised across the European continent representing highly divergent combinations of socio-economic and biophysical characteristics, including the main cropping systems (arable, orchards, vegetables and vines) and farming systems (conventional, innovative / organic) across four European agro-climatic regions (central; maritime; Mediterranean; North-east) – see Table 4.

Table 4. Ecological context of the focus groups.

Agro-climatic zone of case studies	Countries in consortium	Arable	Vegetable	Orchards	Vineyards
Maritime	Netherland			Pear: PC, PO	
	UK	Wheat: PC; Oilseed rape: PO			
	Germany		Pumpkin: PO, PC		
	Switzerland	Oilseed rape: PC, PO			
North-east	Estonia	Oilseed rape: PC, PO			
Central	Hungary	Wheat: PC, Sunflower: PO			
Mediterranean	Italy	Sunflower: PO		Olive: PC	
	France				PC

PC = pest control, PO = pollination

As the studies ran on diverse socio-economic and cultural contexts several factors have an influence on how farmers think and act in the focus groups and which topics they bring into the conversation. In the Quessa case studies we worked with specialist farmer groups, and the topic of the discussion was not completely unfamiliar to the participants; so their ideas may differ from the general attitudes of dominant farmers. The small size of the sample did not allow to homogenise the focus groups according to farm type, farming system, the size of the farms, age, gender and educational level of farmers. These factors had an influence on the discussion as the analysis will show. All in all, the groups reflect well the **heterogeneity and local specificity of farmers** within Europe:

- The focus group participants for the UK Case study all farmed conventionally and farm size varied between 500 and 5000 acres (approximately 200 to 2000 hectares). All farmers expressed their sense of pride and love for the beauty of the countryside. One participant owned the land he farmed but the other three were farm managers. Three of the farms were in the Higher Level Environmental Stewardship and one was in Entry Level Environmental Stewardship.
- In Hungary, the focus group participants farmed conventionally, and only one farm was organic. Two farmers were small scale (14 ha), and two were agronomists from local agricultural cooperatives (5000 and 20 000 ha), also doing their own farming at home. The cultivated crops that appeared on all farms were maize, winter wheat, sunflower, barley and rape. One farm also produced more diverse crops: millet, pumpkin, pea, alfalfa, spelt, etc.
- In the Netherlands six conventional fruit growers participated in the discussion, all members of a study group concerning pear psylla, all with innovative, economic-oriented mindsets. Highly intensified specialised fruit growers and small mixed farms also represented with considerable variations in their attitude towards ESs.
- The focus group participants for the Estonian case study were eight conventional crop producers (cereal, oilseed rape, clover, wheat, barley, pea, grasslands) with farm size between 160 and 1800 ha (~826 ha on an average) and strong connection to the locality. One of them also practised organic and low input farming besides conventional crop production.

- In Italy the Olive Grove Case Study in Monte Pisana (Pisa) ran with seven associates of the olive mill, all with strong emotional connection and appreciation for biodiversity and aesthetics in the mountain and aware of benefits from SNH as well as vulnerabilities. Most participants were professional farmers, taking much care of the vegetation management; one being the owner of a tree nursery and manager of 1250 olive trees, others managing 400-1200 trees; while one farming on 164 olive trees as a passion since over 30 years.
- The Sunflower focus group in Italy was organised with 10 members of contract workers' association of Pisa who also have their own land. One of them practices no-till farming and has a demo farm on soil organic matter conservation.
- In France, the focus group was conducted with 5 wine-growers (owners of private cellars and one from a wine-making cooperative) and all participated in the biological control experiments. Three of them conducted their vineyards in organic management whereas the 2 others were involved in low input systems.
- The focus group in the Swiss case study invited eight farmers, from a distance of approximately 10 kilometres; all from agri-environment schemes and promote biodiversity. Their sense of community was noticeable; and started an open-minded discussion and direct interactions, also expressing a feeling of well-being.
- In Germany, the focus group was organised with 7 local farmers (6 farmers and 1 wife of a farmer) of which 4 were organic. Everyone came from farmer families, and all were born where they work now.

Table 5. Organisational context of the focus groups

Case study	Time	Length	Participants	Sense of community, feeling of flow	Common and differentiating features
FDEA-ART, Switzerland	17th March 2014	100 mins	8 professional fruit growers with an innovative, economic-oriented mindset - highly intensified specialised fruit grower to small mixed farm.	Sense of community was noticeable	Direct interactions among the participants
GWCT, UK	21st January 2015	180 mins	4 conventional big farms (owners or managers)	Informed and comfortable, very cordial and friendly; Farmers remained engaged until end	A full picture of what farmers liked about their farms and landscapes
BXSCAGRO, France	24th July 2015	150 mins	5 wine-growers	Participants were open-minded, ready to listen to each other and expressed a feeling of well-being. Sense of community was very perceptible, through their relations to how they deal with similar problems	A lot of discussions and direct interactions triggered by the results of scientific experiments.
DLO, Netherlands	23rd March 2015	120 mins	6 fruit growers	Pro-active, open-minded; Feeling of community naturally emerged during a walk in the orchard	Members of a study group enthusiastic about pear psylla
EULS, Estonia	7th February 2014	100 mins	8 conventional (160 - 1800 ha)	Cooperative and jovial; Everyone participated willingly and actively	No one felt being left out of the conversation; The main concern was how they can benefit from Quessa

UKL, Germany	14th March 2014	100 mins	6 farmers + 1 wife organic (at the start 2, later 4), conventional 3	Cooperative, sometimes slow, sometimes splintered discussion, but overall good to follow	Everyone found tourism a problem, and all contested management of SNH
SZIE, Hungary	4th March 2014	100 mins	4 farmers (small-scale, cooperative)	Fruitful and intense, lively discussion; No big contrast in the main ideas and approach of the farmers	The question of old farms and homesteads proved to be very powerful and evoked an endless flow of memories, emotions.
SSSA, Italy (Sunflower)	14th January 2015	90 mins	10 sunflower farmers	Farmers were relatively silent and listened to the dominant opinions	Much talk among themselves about problems with farming and regulations; Less interest for ESs or SNHs
SSSA, Italy (Olive)	15th April 2015	90 mins	7 olive tree grower	Discussions helped to ventilate their grievances about legal regulations, national and local politicians.	Hoping that Quessa have an impact on local policy makers

As Table 5 shows the focus groups usually attracted the minimal number of expected participants. Having too few or too many participants makes moderation difficult as too few farmers are less encouraged to speak about their personal opinion, present new ideas, while with too many it is hard to keep focus, give everyone floor to speak. The average length of the meetings varied between 90 and 180 minutes, with an average of 120 minutes, the standard time for focus groups. Usually, the visual exercise and the conceptual linkage of ESs took up more time as this was pre-emptive to gain understanding on the thinking of farmers about ES.

As for the management and group dynamics in focus groups we encountered slight differences in the implementation, although in each case the moderators were successful with keeping focus. Case study reports highlighted various aspects of managing focus groups and practicalities for improving group dynamics. In most cases, the participants were interested in the topic and this created the necessary rapport for the successful group work and smooth facilitation. All managed to create from the start a harmonious understanding and enjoyable discussion for the participants except for the French and Italian case where researchers struggled a bit more with creating the necessary rapport for the group discussion. The main challenge in their case was that many of the participating farmers looked at the SNHs through the ESs for the first time in their life.

In Italy, in particular, there was a tendency of farmers talking in little groups, all at the same time, which was due to the fact that they did not have clear ideas or opinion on ESs and SNHs. Finally, the youngest and most educated farmer who have already participated in other research projects and formulated a more pronounced opinion on many subjects helped the discussion in a way that farmer could easily relate to (confirm or reject) his points. In Estonia researcher did not encounter any difficulties in running the group discussions. After a short freezing period in the beginning and some technical problems, the research questions were well received and triggered interesting, joyful, often funny discussions. In the UK case, 4 members of the QuESSA team were present throughout the meeting. Questions were well received and each participant spoke in turn. As the UK report says, “we discovered what the farmers liked about their farms and landscapes which gave us a fuller picture of their background”. … “There was no sense that participants were bored. Three farmers were particularly outspoken but one farmer was very quiet and difficult to draw out”. In Hungary, the heterogeneity (small scale vs cooperatives) of the mini-focus group with four participants did not lead to any conflicts during the discussions. Farmers were eager to share their feelings, the idea about landscape, ecosystem and ecosystem services which resulted in lively discussion. Three from four farmers knew each other (most probably they knew each other’s background, the past, a way of thinking etc.), while the fourth farmer was from another village unknown for other three. This

"outsider" farmer was less talkative, thus facilitators had to ask his opinion from time to time. In the Netherlands, the feeling of community has been naturally created by starting the discussion with a walk in the orchard. In this was farmers were "warmed up" by discussing the actual infestation level with pear psylla. Later, participants were open-minded, seemed to feel at ease and open to express and exchange their ideas. Depending on personal character their contribution was proactive or responsive. In the Swiss case study, the "sense of community was noticeable". All participants were open-minded, ready to listen to each other and expressed a feeling of well-being. More and more the participants started to discuss with each other. These direct interactions among the participants continued then during the whole focus group. In the German case the moderator was overall successful to keep the focus; cooperative, sometimes slow, sometimes splintered discussion, but overall good to follow.
In sum, it all seems that the group discussions did not face much debate and disagreement about the topic discussed. The groups managed to form an atmosphere where farmers started positive interactions with each other, often reinforcing the feelings, opinion, knowledge of another participant. Farmers were also eager to learn about the field work results in their farms and often prompted the researchers. The role of moderators was also positive in a sense that farmers much appreciated the overall organisation of these discussions and the ambitions of the project.

Mind mapping: ES interpretations and interrelations

A primary aim of the non-monetary valuation exercise was to understand how farmers think about ESs. In the following, we present the framings farmers use to conceptualise ESs in their local contexts. We analyse how farmers make sense of the relationships of ESs: which scales dominate their understanding, what kind of attitudes, feelings, arguments are mobilised when talking about ESs.
ESs were represented by a picture which was laid on the table for the farmers to inspect. These represented the top five ES selected during the previous farmer interviews and the same images were used for the focus group sessions. The moderator or the researchers presented each ES to the farmers through images. Then the mind mapping started by extracting the linkages among the top 5 ESs (see examples of visual representations from case studies below) and discussed these with farmers to better understand their interpretations and personal approach. In essence, mind-mapping gave a graphical representation of the concepts farmers linked to the top 5 ESs in their local contexts (see Table 6 below for ESs discussed in local focus groups). The exercise resulted in completely unique visual representations for the different local case studies.

Table 6. The five focus ecosystem services discussed during the focus groups

UK	Hungary	Estonia	Germany	Italy, Olive	Switzerland	France	Netherlands	Italy, Sunflower
Crop yield Pollination Wildlife Recreation Functional biodiversity	Habitat for games Pollination Water holding capacity Cultural capacity Landscape aesthetics	Soil fertility C-sequestration Pollination Yield Water purification and regulation	Soil fertility Protection against the wind, pollutants, drift Pollination Water regulation Pest control	Collection of food, Conservation of biodiversity, Recreation, Aesthetics Erosion control	Water retention Erosion protection Yields Soil health Biodiversity conservation	Pest control Aesthetic value Soil functioning Yields Water retention capacity	Biodiversity conservation Wind protection Pollination Yields Microclimate	Water quality protection Conservation of biodiversity Recreation, Aesthetics Microclimate regulation

Mind-mapping in the UK case study

In the UK interrelatedness of ES was an important part of focus group discussions. Farmers showed a high interest in the relationship of economic ES such as Crop yield compared to ES which has less tangible benefits. Despite this, farmers were still interested in other ES, but mostly in a secondary sense, in that other ES were important as they benefitted economic ES such as Crop yield and profitability. Overall, however, farmers showed a good knowledge and understanding of the importance of relationships between ES and the trade-offs that may occur as a result of balancing ESs in a landscape.

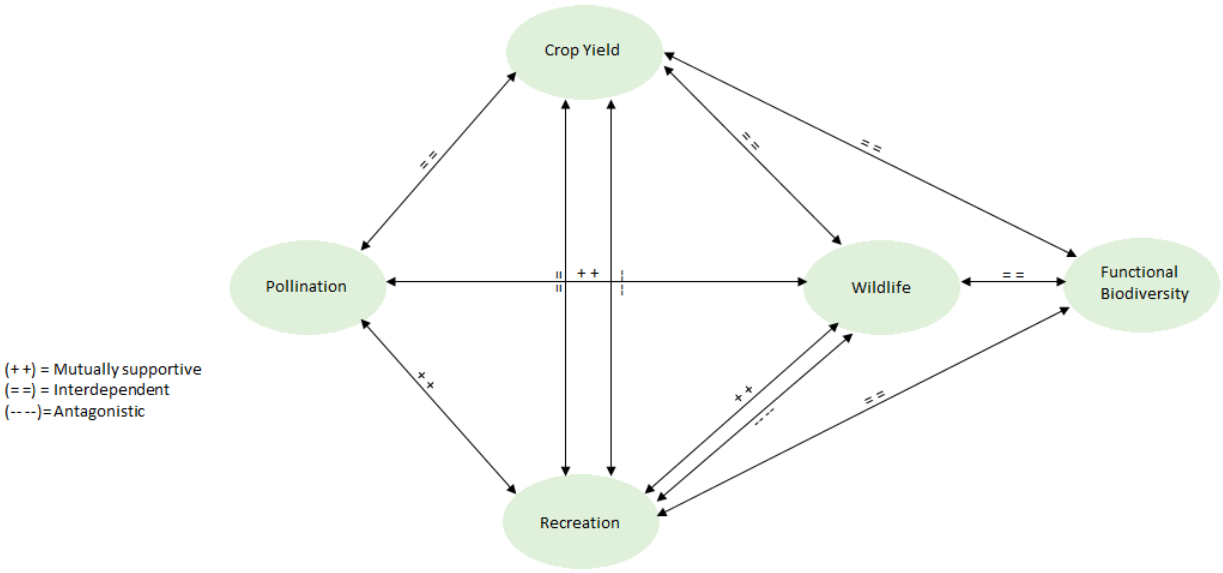


Figure 3. Framing farmers use to conceptualise ESs' relatedness (UK case study).

Within other topics, a similar theme has been recorded in that the ES mentioned across all categories and codes were frequently economic, in particular, Crop yield. Although farmers recognised that all ES benefit from research as an external factor they focused primarily on Crop yield as an ES affected by external factors. Likewise, in the farmers' attitudes to ES they had positive attitudes to Crop yield and associated ES including pollination. Negative attitudes to Functional Biodiversity were observed, with farmers voicing concerns about potential trade-offs with productivity. When discussing ES beneficiaries, unsurprisingly, farmers were able to identify the ES that benefitted them most, namely Crop yield and associated ES. However, farmers also showed awareness of the importance of other ES to other beneficiaries, including recreation and wildlife. Linked in with this, in terms of readiness to care for SNH, the personal interest of Farmers was mainly in ES, which provided secondary effects to economic ES. Farmers felt that Wildlife as an ES was being pushed by Government regulation, which they complained was difficult to keep track of.

The main difference of researchers and farmers' conceptualisation was that the scientists saw the images as representative of an abstract idea whereas the farmers were very engaged with the detail of the pictures. For example, in the 'Wildlife' picture they wanted to know '*what are these birds?*' whereas the scientists had chosen the picture as representative of any farmland birds or wildlife. For the main ESs, several interpretations emerged. As for crop yield, farmers had a very strong awareness; they correlated it very strongly with 'profit' which became at the heart of the discussions. They described it as being 'everything'. Supporting and regulating services that biodiversity provides (Functional biodiversity), were less obvious to the farmers and needed clarification. After some discussion, the groups arrived at a consensus that these are clean water, soil condition or pest control. Pollination as a regulating service was singled out as it one of the foci for QuESSA (natural pest control had been included in the original interviews but was not selected as a priority by farmers). Farmers understood this in relation to their farming success: as the provision of insect pollinators to maximise yield. As for recreation, the image included pictures of walkers, birdwatchers and people engaged in country sports however the farmers had a further interpretation of recreation. For them, it included educational activities. When asked about 'recreation' they frequently spoke about their own organised activities for the public. Finally, wildlife was clearly understood by both farmers and scientists as the wild animals and plants on farmland.

Mind-mapping in the Hungarian case study

In Hungary, the question of economic success and ESs became an important theme of the discussions. The interrelatedness of ES was not that central part of discussions with farmers and SNHs were not

considered particularly beneficial for farming. An interesting contradiction emerged between farmers' identity as crop producers and local residents when they value ESs as "speaking from their heart or mind".
For the five main ESs, interesting interpretations and framings emerged. The economic success of farmers has been often associated with wildlife. The focus group recorded an ambiguity on how farmers understand Habitat for games as an ES. In one sense they suffer from wild animals destroying crops and feel that this is an external push by regulations. Farmers claim that there is "no need for the game in the countryside" or at least "I am not against animals, but it is chaotic to have lands withdrawn from production just because animals need a hiding place, and then they make damages". A farmer who goes often hunting suggests that probably farmers could create more hideout habitats for the game for higher subsidies. On the other hand, they see positive outcomes of hunting related to tourism and recreation. As one farmer puts it: "The hunter arrives and I provide accommodation, local food and drinks from local producers and he gets to know the landscape. The hunter goes out and sees the local values. He appreciates the homesteads, the artwork in the landscape and he finds himself in the landscape, too." Overall wildlife as ES is regarded from a utilitarian point of view, and farmers' attitude towards wildlife as an ES depends on how much economic gain they provide: for some farmers, it does some, for others basically none. In contrast, it was completely the opposite with Pollination as an ES, since they even recorded a decreasing trend in the number of natural pollinators and had personal experience that yields are higher if there are wild bees around. Farmers clearly understand that their yields directly depend on pollinators (e.g. alfalfa pollinated by wild bees from SNHs) mostly from this utilitarian perspective.
As for water holding capacity, the picture was very mixed. Farmers discussed that SNHs react to the anomalies of water distribution just as their own fields. Inland water as the main concern emerged for arable farming. As for the Cultural capacity the discussion pointed out the role of homesteads in self-sufficiency and also as natural habitats and providing many fruit trees that may not be found anywhere else. Landscape aesthetics as an ES invited a discussion on how and where farmers imagine good life ("I cannot imagine myself in a mountainous area" or "Life in the countryside is relaxing.") Overall, it seemed that only limited number of farmers interpret ESs and SHNs as beneficial. Most often farmers have to face negative consequences of wildlife and precipitation (water holding capacity) and this clearly means a critical problem in farming and no surprise, farmers could not really go beyond that in their valuations. Furthermore, farmers' interpretation of ESs clearly showed the context dependency of the concept. When speaking from the point of view of a local resident, farmers clearly knew what ESs provided by SNHs, whereas when valuing those from the farming point of view they tended to express their economic interests. We conclude that farmers most often interpret SNHs as a necessary but bad thing, and ESs as limited and niggling, that does not really affect their livelihood, though still can have a huge effect on their personal life (wellness, cultural roots).

Mind-mapping in the Estonian case study

In Estonia, the question of the interrelatedness of ES provoked a fruitful discussion. The concept of ES proved to be relatively unknown among farmers. They all considered strange to look at these things as "services" to and from nature. The idea of valuation seemed to be appealing and farmers tended to assess the value of ESs similarly. As the main point, the group discussion concluded that farmers positively assess only those ESs from which they clearly derive benefits. The mind maps show positive relations towards Soil fertility, C-sequestration, Pollination, Yield, Water purification and regulation. all other All ES are secondary compared to crop yields which are providing the most tangible benefits and being the main prerequisite for all. Farmers already developed a good understanding of the importance of relationships between ESs and also how losing one can in return gaining another.

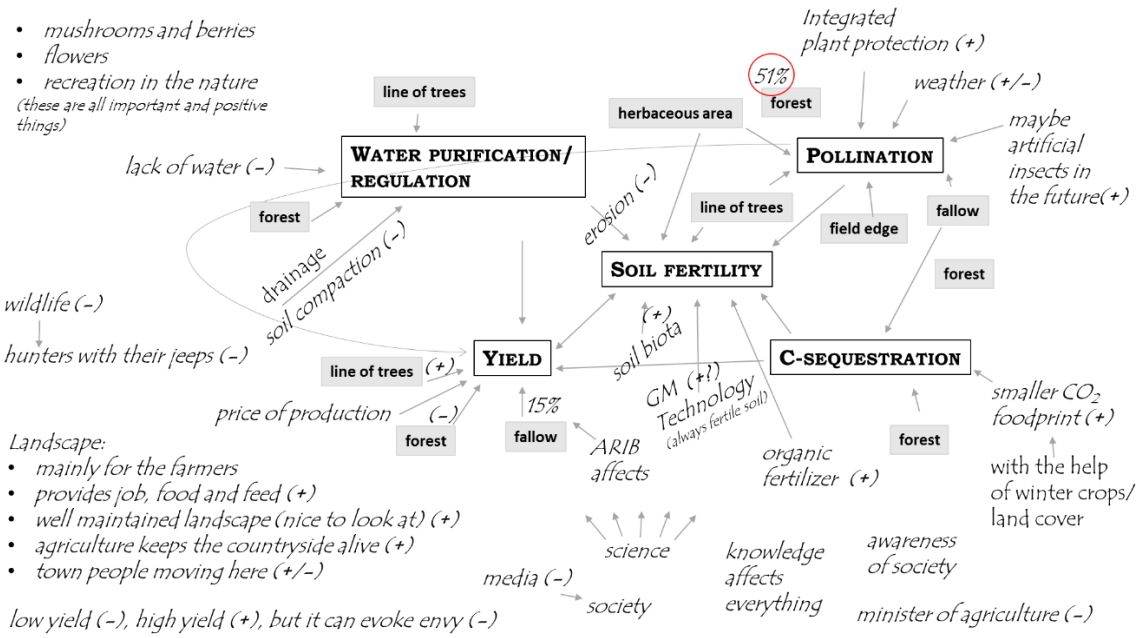


Figure 4. Framing farmers use to conceptualise ESs' relatedness (Estonian case study)[1]

Mind-mapping exercise in France

The mind mapping exercise in France was a bit more tough-going than expected. Farmers and researchers faced difficulties to organise their ideas around the interrelatedness of ESs. Finally, SNHs and vineyards have been contrasted to bring out connections. In fact, vine-growers were mostly concerned about their own problems and especially how pesticide use is perceived by society and policy. Landscape aesthetics proved to be an important element of discussions as related to the preservation of biodiversity in SNHs. Farmers have a good understanding of the difference of ESs (mostly pest control) preserved in SNHs and the vineyards. In essence, farmers liked the idea the research focuses on their plots and especially that "vineyards are not completely abandoned by arthropods due to the use of pesticides. As for the most valued ESs, yields and the quality of grapes in vineyards proved to be the most valued ES. It is important to note that rather than quantity, farmers particularly focussed on the quality issues of the yield, which understandable in the context of AOC (Terrasses du Larzac appellation).

Mind-mapping in the Netherlands

In the Netherlands, much discussion emerged on the interrelatedness. Farmers were most interested in linking yield to other ecosystem benefits. As a rule, when growers profit from an ES they also cultivate more positive attitudes. This is also reflected in their willingness to care for an SNH that supports that service. Overall, farmers showed a good understanding of the ES concept and the importance of relationships between ESs. Most importantly, as expected, ESs are related to their own farming and their profit from ESs. Therefore, farmers often neglect ESs related to recreation and conversation of cultural heritage. When prompted, the most important ES for farmers was "Yields". Not only the number of pears harvested but the financial outcome which is also much related to quality produce. Therefore, they also interlinked this yield with the necessity to hire bee hives or to apply pesticides and the associated costs.

[1] ARIB: Agricultural Registers and Information Board, Estonia

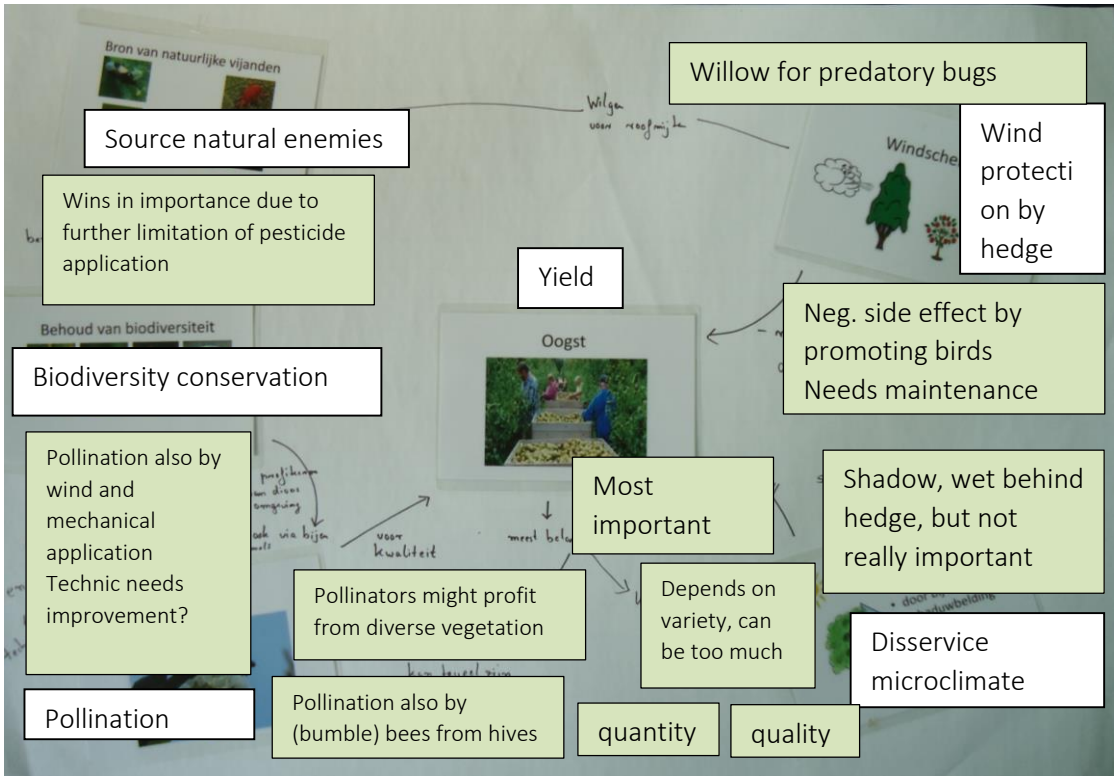


Figure 5. Framing farmers use to conceptualise ESs' relatedness (case study from the Netherlands)

Mind-mapping in Switzerland

In Switzerland, the interrelatedness of ESs fuelled an interesting discussion about antagonistic relationships of economic ESs and non-economic ESs.

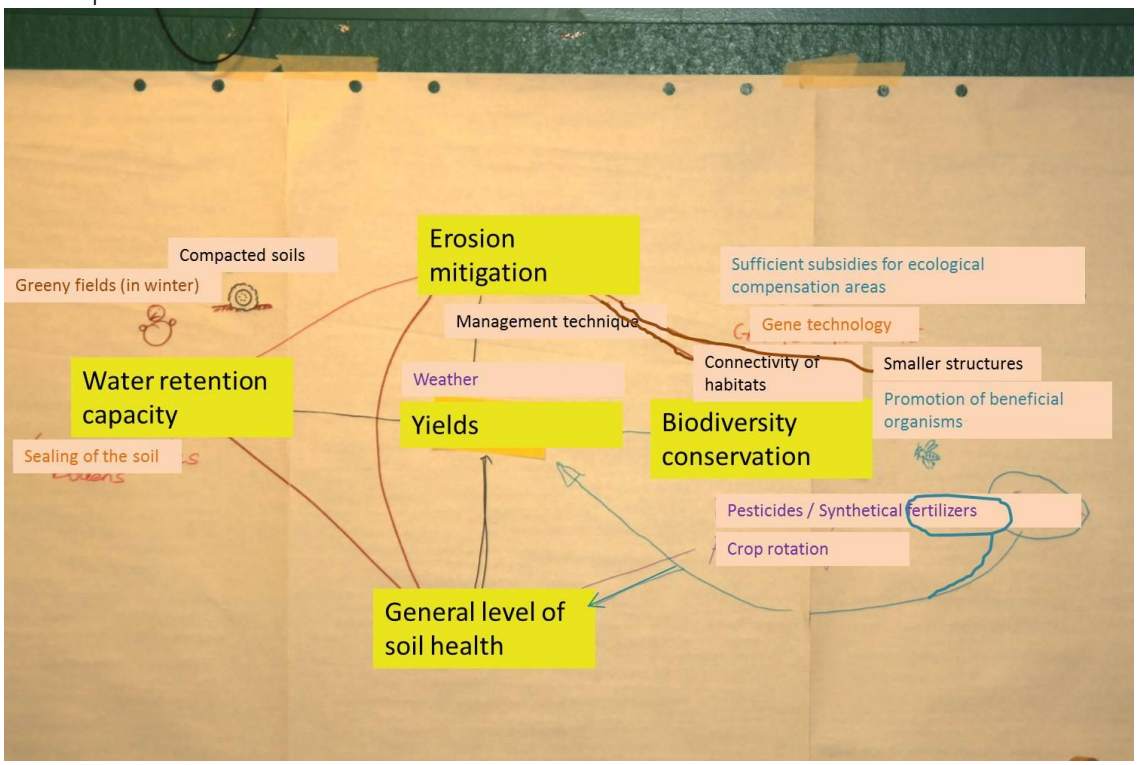


Figure 6 Visual display of relationships between ESs discussed in the Swiss focus group

Yields being the centre of farmers' understanding is easily compared to secondary ES with less tangible benefits, such as "recreation, aesthetic value". Trade-offs have been discussed first, with regard to expectations of the broader and local community as well as governmental regulations, and second as farmers' ambition to produce high yields. Mutually supportive ESs such as "general level of soil health" and "yields" offered farmers to go deeper into technical debates about management. Farmers understand "yields" not as monetary value but mostly as overall product quality linked also to the amount of produce and the value assigned by the market. Therefore, "Yields" is understood as the most direct feedback of their farming. Furthermore "yields" also mean the beauty of a meadow or fallow as a result of their farming.

Mind-mapping in Italy with the Olive focus group

In the Olive focus group of Italy, several ecosystem benefits have been discussed beyond yields. Farmers had a good understanding of the concept and the importance of trade-offs among ESs as related to their olive growing. They also highlighted that ESs are provided on the landscape level.

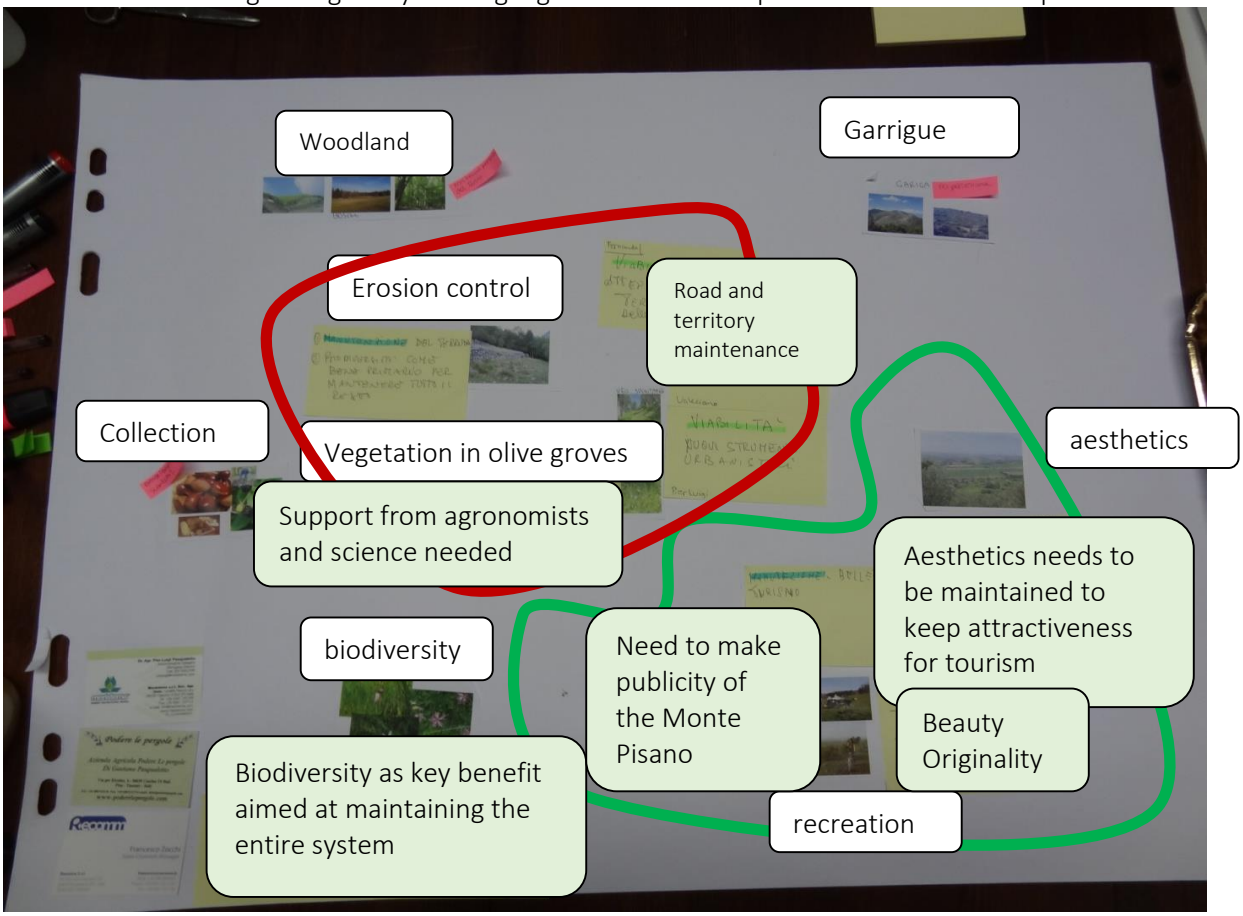


Figure 7. Visual display of relationships between ESs discussed in the Italian Olive focus group[2]

Olive growers, in general, do not easily relate the SNHs of woodland and scrubland. The focus of discussions was about management and infrastructural issues that make olive groves easier but also extended to landscape aesthetics and maintaining the landscape in terms of improving tourism, roads, and stone walls. The strong landscape value of olive groves has been many times acknowledged and especially the tourism aspect inspired vivid talks: "If people want to learn to know Tuscany, they come here to know real Tuscan live. Probably in Buti, we should exploit this strength better." Discussions also pointed out that the bureaucratisation of farming also needs researchers and agronomists in new

[2] The red circle connects olive grove vegetation to erosion control; the green circle connects the importance of aesthetics to recreation, but this was not connected to a particular SNH but to the entire Mountain.

roles to support hobby farmers to maintain the olive groves. The feeling of abandonment by policy makers and not much understanding by the general public and the people that buy olive products were recurring themes.
Farmers pointed out several types of linkages of ESs and SNHs: 1, seeing ES as result of the 'mountain' habitat and not as coming from a specific SNH; 2, benefits come from the olive groves; 3, natural woodland considered as most important SNH for ES provisioning. Trade-offs were well understood and explained by one farmer in the following: "We work a lot and try to avoid to use pesticides, but there is no recognition for all we do. If we do treat with chemicals all local people and tourists look bad at us because we are seen as the ones that poison the world. But if we raise the price of olive oil they all look at us as if we are mad because they think it is too high. But we do not even gain anything if we ask 10 euros per litre."
The general feeling was that hobby farmers/olive growers provide services to the territory and to the community. They maintain the functions of the landscape: olive groves, stone walls, terraces, houses (otherwise abandoned), roads (repair after landslides). Therefore, the connections to the territory were very strong through farming as a lifestyle.

Mind-mapping in Italy with the Sunflower focus group

In Italy, the Sunflower focus group showed that even is farmers have a good understanding of the ES concept the interrelatedness of ESs is not so easily captured. Their willingness to care for SNHs was central during the discussions. Farmers showed strong attachment to the landscape they live in especially from an aesthetic point of view. They also acknowledge that recreation is related to especially woodland and this is interesting also for some of them but generally they have little time to enjoy the landscape for recreational activities. During the discussions, ESs were mostly seen as separate issues, and farmers do not automatically associate ESs. SNH management was a core issue during the discussions as farmers felt that local authorities do not manage the SNHs correctly.

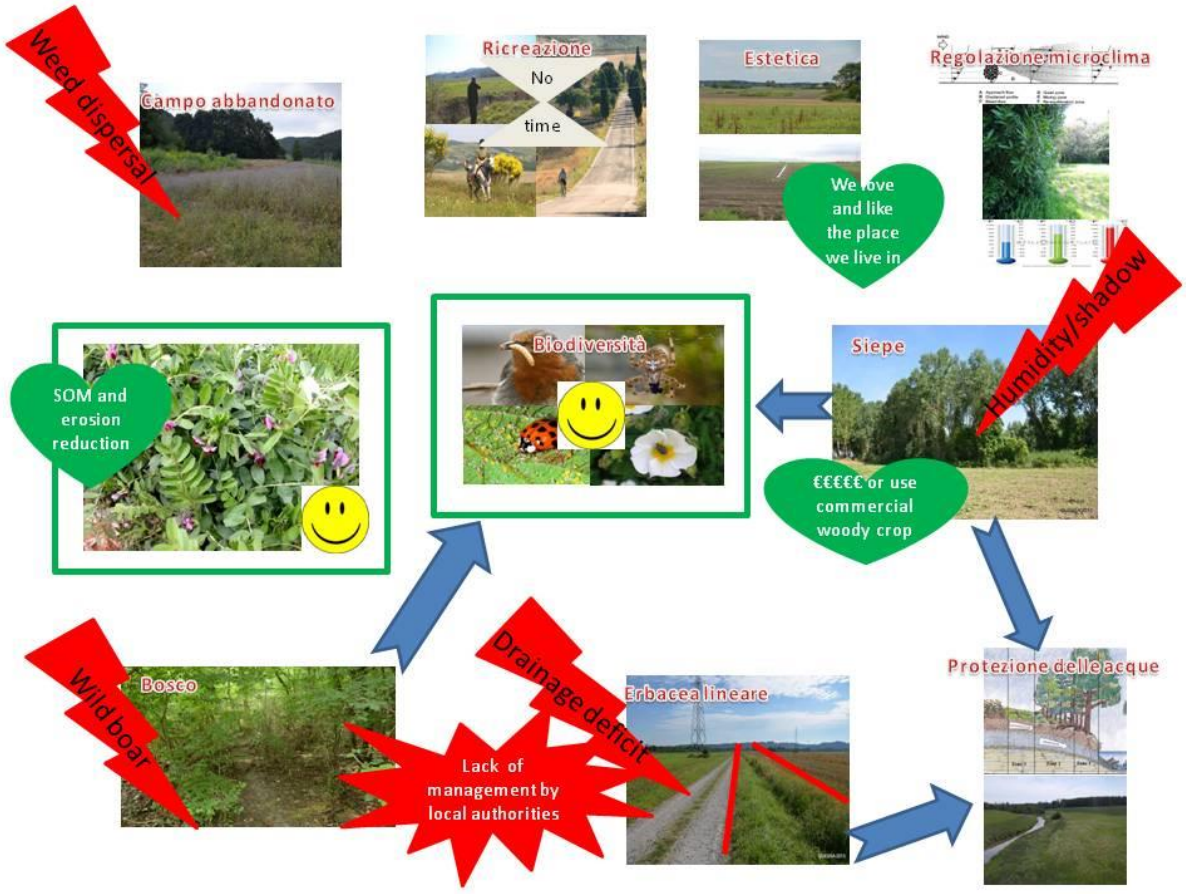


Figure 8. Visual display of relationships between ESs discussed in the Italian Sunflower focus group

For farmers, the only SNH with real interest was cover crops as being most efficient in reduction of nutrient leaching and SOM conservation. They do not think permanent buffer strips are a good option in the Pisa Plain because fields are too small but cover crops are more effective and easier to manage. SNHs such as hedgerows were considered rather a nuisance in a sense that fields are already small due to dense drainage channel system and therefore any woody plant is removed if possible and for sure is undesired in farming. Moreover, according to farmers even if hedges r woodlands reduce salt sea-winds they are too humid and shady and cause a big loss of crop production. Wildlife in the woodland insufficiently managed by the of the Nature Park often results in damages in the crop. In essence, farmers are suspicious to any type of SNH that is not implemented and managed by them. According to farmers' experience, SNHs are best managed by themselves and typically not by local authorities who often abandon them and cause trouble for farmers (wild boar, floods, weeds, shade and humidity). In this sense, conservation of biodiversity in SNH is welcome but this has sense only if the SNHs are not abandoned and left „messy and full of weeds". Finally, crop diversity is mentioned as a lost heritage and induced nostalgic feelings: according to farmers, agricultural politics have made it impossible for them to maintain crop diversity (e.g. abolition of support for sugar beet).

Mind-mapping in Germany

In the focus group discussions in Germany, farmers showed very good understanding of ecosystem benefits and farmers often mention SNHs when they interpret ESs. The relationships between ESs are mostly centred around profit from ESs for their own farming.

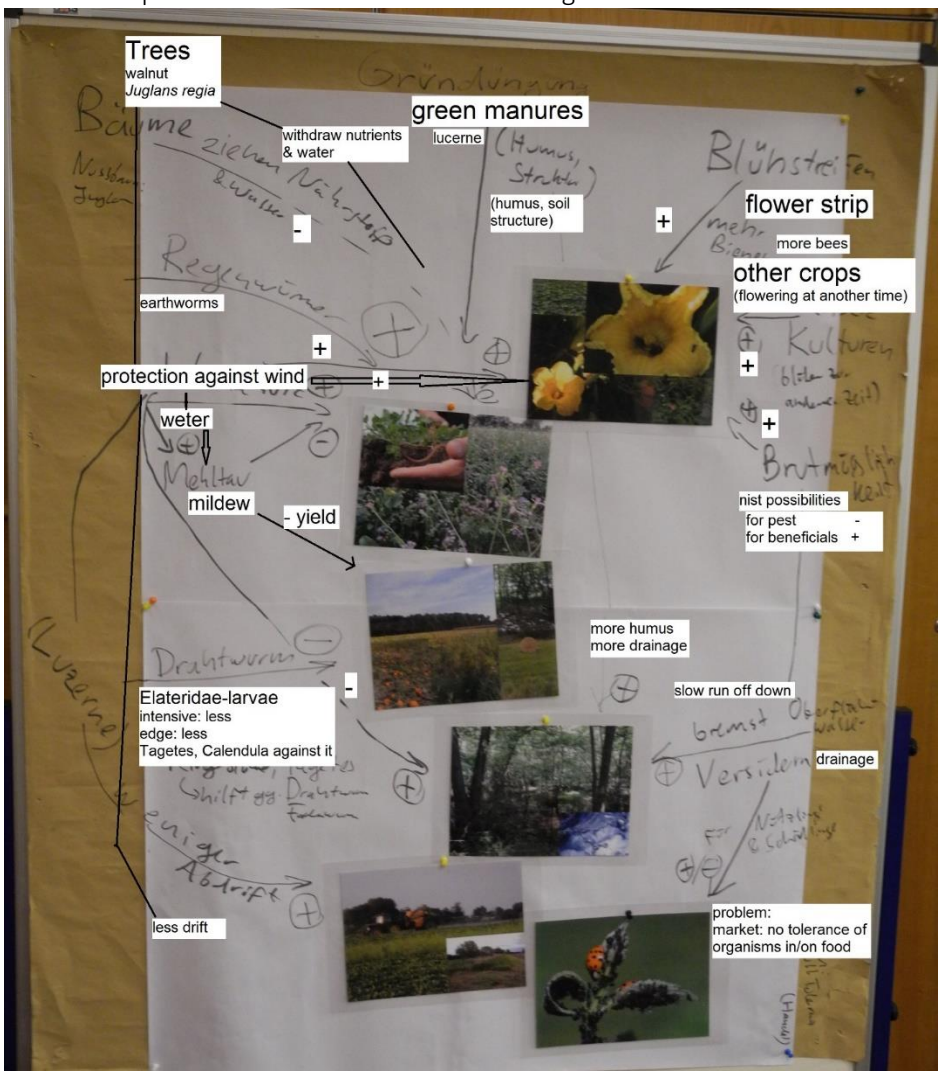


Figure 9. Relationships between ESs discussed in the German focus group

Soil fertility has been mentioned as being provided by humus content, and positively related to water retention and soil structure (more water on field decreases soil fertility and in turn more humus can store the more water in the soil). It is maintained by farmers with green manure, adding dung, and especially mustard as a preparatory culture for pumpkin.
Protection against wind erosion is provided by hedgerows. Hedgerows can also support pollination but still reduce yield through shadow and mildew. In fact, farmers emphasised that trees usually withdraw nutrients and water which has already visible effects in farmlands.
Pollination as farmers also experience is provided by bees, honeybees, wild bees and bumble bees. In their case pumpkins are more attractive than other flowers: "I did sow a flower strip next to squash last year with Phacelia, cornflower, I saw a lot of bees there and they were also visiting the squash flowers when they were open. I want to do this again this year". or "It works if the nectar from the other flowers is less tasty than from pumpkin."
Water regulation invited two ways of interpretation: Slowing down of surface runoff or retention of water in the soil.
Perceptions of pest control are again controversial as field margins are nesting and rescuing sites for beneficial organisms but also for pests. Natural enemies are provided by Staphylinidae, Carabidae and lady beetles. Main (mentioned) pests that invade from the field margins are aphids, all lepidopteran species (Diamondback moth), carrot flies, flugs, thistle, Senecio jacobea. Some pests (pests in the SNHs) are needed to build up the beneficial population, to have enough of them, when the pest arrives. Otherwise, there is a time shift, often the beneficial organisms are not fast enough in controlling the growing pest population.
As a rule, we contend that growers see the interlinkages of ESs quite well especially through those ESs that directly benefit them; they can easily relate those to their farming success.

Key messages from Mind-Mapping

In general, we report from farming communities that feel abandoned by policy and also do not gain much understanding by the public and the people that buy their products. Although ESs is a purely scientific concept that is relatively unknown in farming communities and does not automatically translates to farmers' everyday farming experience, our case studies show that farmers can develop a practical view of the ES concept which most often relies on seeking the benefits for their own farming practices. Farmers have established varying levels of knowledge and experience of ESs in different local contexts, and although in the beginning, they feel uneasy to translate "services" to and from nature their overall level of knowledge and understanding of the importance of relationships between ESs is good.
Discussions highlighted the interrelations and the complexity of ESs linkages that farmers tend to interpret through farming success, often measured in yields. In other words, farmers easily relate to the concept if their farming is directly shaped by the ESs and impacts success of farming. Therefore, no surprise that in farmers' eyes ESs are not necessarily beneficial: most often farmers are the primary stakeholders who face negative consequences of ESs such as in the case of wildlife and precipitation (water holding capacity).
In essence, farmers shared a broad range of personal observations about ES linkages with SNHs and they also showed an ethical stance, a feeling of personal responsibility for those. Farmers also differentiate ESs preserved in SNHs and their own land.
Reflecting the complexity of the problem, often the typical narratives of farmers pointed out mutuality and contradictions in ES linkages with SNHs.
Overall, the ES concept offers a fruitful frame for discussions with farmers and mind mapping those ES linkages proved to be a helpful exercise that resulted in substantial knowledge sharing among farmers. ES concept, therefore, can offer a neutral, un-contradictory frame of reference to the values.
Already from the mind mapping, it became clear that in the eyes of farmers, economic ES and especially yields are everything. Yields create the dominant framing especially in relation to other ESs

(how these can maximise yield). It is important to highlight though that yield is not equal with money gained in exchange for produce, therefore not only understood in terms of quantity, but rather as an overall quality of farming.
The interpretations of ESs also pointed out an interesting split in farmers' identity as professionals and local residents, which points to uneasy management roles farmers have to fulfil in their own local institutional settings. Essentially, the exercise helped to highlight that many studies focussing on valuation often forget, that farmers do not just farm. Beyond professional cultivation of the land, they see their surrounding as a person living and working in that landscape.

Attitudes towards ESs

Farmers' conceptualization of ESs revealed a lot also about their attitudes towards ES-friendly farming. Already from the mind mapping exercises, it became clear that negative (frustrated, irritated, dissatisfied, sceptical, suspicious, sacrificing or worried) judgements are not rare. Positive feelings (satisfied, appreciated, nostalgic, interested, curious) dominate when farmers relate to ESs that directly helps their farming success. The main anchorage of these feelings were memories from the past and direct emotions attached to land. The analysis of attitudes revealed that farmers prefer rational/professional arguments when they talk about ESs in their farm and like to express non-rational viewpoints when they address generally nature or the landscape.

The UK focus group: attitudes towards ESs

The dominant attitude towards ESs was very rational and utilitarian. The principle interest for the farmers was crop yield as it is correlated, as farmers emphasised many times, with their profit. One farmer underlined that the price of crops was driving his ability to provide ES and said '*if you have got no price you have got nothing to work with.*' and another said '*got to pay the bills, the farm [business] has to be sustainable. The sport, the leisure, the wildlife comes second. A close second but they still do come second*'. The current Environmental Stewardship (PES) schemes have been mentioned as offering not sufficient for services such as pollination as '*it was quite expensive to buy these seed mixes*'. Also that the schemes were rather short-term (5 years), one said '*It is a long-term thing. It takes a long time to create habitat and maintain it and get what you want*'. There was also some criticism of governance, that changes and cuts to administration were making it difficult to plan long-term as there is restructuring '*with every change of Minister. Six months is a long time for a Minister'.* In contrast, farmers were surprisingly positive about recreation, even though they did acknowledge that recreation could be detrimental to their crops or wildlife if uncontrolled. They felt that the farm is their '*shop window'* and that it provided them with opportunities to Wildlife and Pollination were both seen as benign, neither were given much attention in the discussions, particularly pollination. There was a feeling that these were fairly straightforward ESs with few manageable drawbacks. Farmers were ambivalent to functional biodiversity as they perceived that there were risks as well as benefits and this ES was the second most discussed. Farmers also discussed their need for R&D to develop technologies to deliver ESs, they were clear that they wanted their R&D based '*on science'* not on what '*government or NGO lobby groups'* wanted.

Estonian focus group: attitudes towards ESs

Estonian focus group participants' attitude towards the 5 selected ecosystem services was homogenously reasonable. Yield is a necessity to all. Hence, the effect other ecosystem services have on yield influences farmers' attitude towards them. All ESs negatively affecting yield has been described as undesirable, regardless of their potential positive effects. It is in this sense that the typical attitude towards wildlife is not so much admiration but fear of damage to crops. Similarly, forests are generally beloved and are something to be proud of, however, according to farmers' experience cultivated areas bordered with forests produce less yield.

Italy – Sunflower focus group: attitudes towards ESs

The dominant attitudes were calculative, in a sense that farmers regard their own farm management as key to obtaining the desired ESs from SNHs. This results in attitudes being very much context-dependent. Positive attitudes often relate to the reduction of nutrient leaching as vegetation strips along drainage channels could be important to reduce nutrient leaching, however, farmers' fields are too small and they use cover crops instead of permanent vegetation strips. Their positive attitudes towards recreation are dependent on good management of woodlands and efficient control of wild boar. Attitudes towards microclimate regulation are mixed as woodland and hedgerows reduce wind speed and saline sea wind, but near the woody element, production is very low. Farmers have positive attitudes towards Biodiversity conservation especially in not cropped areas.
However, the general sense of these attitudes is that in Pisa Plain management is not correctly performed in the SNHs (by the local authorities), therefore ESs are more of a nuisance to agriculture than a real benefit. Clearly, farmers regard themselves the victim of insufficient management by local authorities. All in all, farmers do not automatically associate beneficial ESs for their agricultural activities from SNHs. According to farmers, crop pollination is sufficiently done by honeybees and they have no clear perception of pest control by natural enemies.

Hungarian focus group: attitudes towards ESs

As the Hungarian report explains, in general, farmer's attitudes towards SHNs are rather positive. They are well-aware of the ESs and especially those that help to farm such as water holding capacity and pollination. As the main concern, service and disservice of "Habitat for games" were very much in the focus discussions. Farmers interpret SNHs and ESs in an ambivalent manner, in a sense that SHNs provide ESs but more likely enhance the disservices. Positive attitudes towards SNHs and ESs have been triggered by talking nostalgically about past homesteads. It also seems that farmers find it hard to bring together the *dichotomy of both positive and negative qualities of ESs*. For example, the same farmer is dissatisfied with wildlife management as a professional producer suffering from crop damage and fosters positive attitude as a local resident when taking his grandson into the nature to show wildlife. In fact, farmers understood the necessity of SNHs but also claimed that nowadays economic forces and farmers' old routines can overwrite this attitude.

Netherlands focus group: attitudes towards ESs

The attitude towards ecosystem services was mainly driven by the direct benefit or negative effect they have for the grower. Farmers most often link the ESs to their work and conclude whether they can directly profit from it. Farmers in the Netherlands did not particularly express emotions when discussing aesthetical values of the surrounding landscape.

French focus group: attitudes towards ESs

French focus group farmers voiced their positive attitudes for the landscape and biodiversity sheltered in SNHs. Discussions were mostly about functional biodiversity that has a role in the regulation of pests and pathogens in adjacent vineyards. Arthropods, birds, parasitism in SNH have been found as a positive factor to control insect pests in vineyards; whereas disservices are also acknowledged. The role of hedgerows against frost or the wind, and pesticide drifts, as well as a hiding place for bees, have been mentioned positively. Soil health was also positively framed: "good soil is the basis for all the other things". Soil fertility and quality (biodiversity and nutrient level) are very much associated with "terroir". In sum, the general attitude to ESs was positive as farmers have a good understanding of various ESs needed for optimal yield and best quality for each vintage. Landscape aesthetics have been again positively framed as farmers agreed that beauty associated with SNH in agricultural landscapes needs some conservation and valorisation of remnant woody or herbaceous areas to maintain heritage value and regional identity.

Switzerland focus group: attitudes towards ESs

In general, farmers showed strong positive attitudes towards ESs as their daily work is mostly about "General level of soil health", "Erosion mitigation", "Water retention capacity" and "Yields". Farmers tended to frame soil health as prerequisite of any farming: "without a healthy soil, all other things would not be possible", "the most important for a farmer is to have healthy soil" or "it is the basis, the basis for our work" or "soil is like the capital and the yields is the interest that I get."
Farmers showed ambivalent attitudes towards "Recreation, aesthetic value" and "Biodiversity conservation", mostly in a sense that "areas reserved for promoting biodiversity provide a huge workload" or "30% of areas reserved for promoting biodiversity requires 50% of all farm work". Interestingly, farmers do not automatically frame "yields" as positive and also mention the danger of over-production, price decline and less income for farmers.
Finally, the exercise also helped to highlight what many studies focussing on valuation often forget, that farmers do not just farm. Beyond professionally cultivating the land, they see their surrounding as a person living and working in the landscape: "enjoy its colours and diversity and as a result, they also feel happy and peaceful".

Germany focus group: attitudes towards ESs

Positive attitudes towards soil fertility have been recorded as derived from green manure on the field. Soil fertility is positively related to water retention/regulation as well. Farmers also develop a positive attitude to pollination, valuing it as an overall beneficial ES. Ambivalent attitudes go for Pest control. Pest control is especially important for organic farmers, but it is not easily done and there are problems because the market has a zero tolerance for arthropods in the products. Similarly, "Protection against wind erosion" can have also negative effects via shadow, nutrient and water abstraction and foliage on the yield. Protection against pollutants is also related to protection against the wind, but in general, the current regulations to protect against pollutants are seen as sufficient. Finally, water storage (regulation) in the field is positively related to soil fertility, but compaction is a problem with humus rich soils.

Key points on attitudes towards ESs

ESs are most often evaluated against personal experiences in farming and talking about these experiences mobilised positive and negative emotions from farmers; though rational arguments dominated the discussions. Even though farmers acknowledge that ESs could be detrimental to their crops, in general, they had positive attitudes towards ESs, especially about yields, pollination, recreation, landscape, biodiversity conservation, reduction of nutrient leaching, soil health and fertility, microclimate regulation. Moreover, farmers suggested that these are mostly dependent on good management of SNHs, being often the competence of non-farming local stakeholders. Nevertheless, the most interesting part of the discussions was about unfavourable effects of ESs. These have been most often mentioned from the fear of growing costs. In Estonia all ESs negatively affecting yield has been described as undesirable, regardless of their potential positive effects. In Hungary farmers also found it hard to bring together the dichotomy of both positive and negative qualities of ESs. In the Netherlands attitude towards ESs was mainly driven by negative effects they have for the growers. In Germany, discussions highlighted ESs with negative effects on the yield. Ambivalent attitudes emerged as farmers find it hard to bring together the dichotomy of both positive and negative qualities of ESs. Farmers formulated ambivalent attitudes towards any ES if there is a chance to enhance disservices, or their maintenance is risky or *requires too much effort*. Pest control is very important for farmers, but it is not easily done and could easily destroy produce. It is also in this sense that they frame "yields" as negative drawing on their experiences of diminishing market value through bad quality or over-production.

These value commitments also reveal that farmers use their rational/professional arguments when they talk about ESs in farming; whereas non-rational viewpoints dominate when they address generally nature. Essentially, in their professional producer roles, farmers are relating in an instrumental (rational) way towards ESs. Whereas farmers also refer to feelings, emotions, personal values and identity when they talk about non-economic ESs.
Finally, farmers also discussed their need for better policies and R&D to deliver ESs. Most suggestions show that they prefer policies based on research and not on government or NGO lobby groups.

Beneficiaries and benefits derived from ESs

A main aim of the non-monetary valuation exercise was to extract farmers' knowledge on benefits and beneficiaries in their local contexts. We analyse how farmers value the role of different beneficiaries and who enjoy the different values of ESs.
In the UK focus group yield (profit) was the principle benefit for farmers but farmers also highlighted recreation. This was seen as a way of communicating the value of farming to the local community, either directly via an organised 'open farm Sunday' and they saw allowing recreation as something necessary '*with the growing population and the country becoming more and more crowded*'. The benefits to the farmer are two-fold: it secures their business locally and enables them to have good relationships with their neighbours which are good for business and also there was a certain amount of pride and satisfaction in being able to demonstrate a job well done. Functional biodiversity was also acknowledged, especially the role of nutrient turnover and 'good soil' which benefits crops as well as pollination and natural pest control, although farmers were quite sceptical about how much impact these had on crop yields. All ESs were seen by farmers to benefit the local community. The crop yield was interpreted as a successful farm business and it was considered that this would mean thriving local community services (such as a shop) from which the local community benefits. Pollination, wildlife and recreation provide a feel good factor locally, pollinators providing aesthetic appeal and recreation also having health benefits as did functional biodiversity. The broader community was seen to benefit only from wildlife and recreation in as much as it confers a feel good factor.
In the Hungarian focus group economic benefits (yields) were emphasised by farmers most of the time but pollination and landscape aesthetics are also important benefits for farmers. Recreation, wildlife, hunting also brings important benefits as farmers feel better connected to their local communities. Other ESs such has "habitat for wildlife" can enhance benefits of the local community or broader community through wildlife, hunting and beautiful landscape. The broader community benefits from SNHs or the whole landscape through e.g. landrace fruit trees at homestead places.
In the fruit growers focus group in the Netherlands, the main benefit is yield. Indirectly, they profit from predation, pollination and hedges for wind protection as well as these ES contribute to a functioning fruit production system. In a broader sense "Biodiversity conservation" supports the ESs predation and pollination by supplying habitat and alternative food sources for bees and other beneficial organisms. "Recreation, aesthetic value" is of substantial importance for tourism and the local community. Farmers are not directly in contact with tourists but the local community does make efforts to further improve the area for recreation. Also, for the local communities themselves the aesthetic value of the landscape is of high importance, as it increases the willingness to settle in that area. For the broader community "Water protection" is an important issue in areas with many open water areas adjacent to intensively used orchards. Regulations to grow hedges or use adequate application techniques are based on national laws.
In the French focus group, it was also the yields that provide income for vine-growers. Producers are also aware that they are responsible for a cultural product with far-reaching societal consequences. The aesthetic values of the landscape around their vineyards are particularly important for property sales, and especially during the touristic season. Biodiversity conservation and the service it can provide to regulate the pests inside the vineyards is particularly acknowledged by wine-growers, regardless their management systems. Local communities and tourists benefit a lot from the good

image of the landscapes, although the group discussion also emphasised that vine-growers need to better communicate with the local community.
The Estonian focus group mentioned several benefits for farmers. Woody areal elements effect C-sequestration, water regulation positively, however in terms of yields cause problems at the farm level. Wildlife and hunting are not regarded in any way beneficial for farmers. As benefits for the broader community mushrooms and berries from forests were mentioned. High level of forestation (51%) in Estonia is also a benefit for the broader community and farmers also feel proud. Woody linear elements bring many benefits to local farmers in soil fertility, water regulation, yield, pollination C-sequestration, buffer/wind break, but again the maintenance of these can be quite difficult. Herbaceous areal elements provide pollinators with pollen and have a positive effect on soil fertility, moreover provide a place to rest for hikers and also bikers. Herbaceous linear elements can benefit pollinators. Fallow land and winter crops contribute 15% to yields, and it helps pollination, soil fertility and C-sequestration.
The Italian Olive focus group farmers in this mountainous area have the basic attitude that they provide services to the Mountain as the territory is extremely fragile and prone to landslides. All vegetation growing on the Mountain needs maintenance, both olive grove and the planted and abandoned woodlands. Therefore, the general understanding of benefits derived from ES starts with the acknowledgement that the ESs are results of hobby farmers' maintenance work. Local community and broader community also benefits through olive groves as a tourist attraction and an image of authenticity in Tuscany.
The Italian Sunflower focus group do not perceive to receive benefits in terms of ES from the SNH in the Pisa Plain. On the contrary, they feel many SNH cause them problems or do not fulfil the function they have (drainage channels). Still, some recreational benefits for farmers such as walking in the woodlands, or horse riding has been mentioned. Local community benefits through maintained areas for walking, cycling, riding on horses. Non-farmers benefit from the nice-looking countryside but have conflicts with farmers about dust, agrochemicals and manure. From the wider community, many tourists are attracted to Pisa Plain.
In the Swiss focus group, the principle benefit for farmers was "Yields" ("Erosion mitigation" as it positively affects "Yields") that provides income and also represents their efforts to produce sufficient, healthy food for the wider community. Furthermore, "Recreation, aesthetic value" as a community level benefit, also contributes to the positive image of farmers in the wider society. "Biodiversity conservation" is mostly admired by the wider communities for rich flowering meadows. It also fulfils farmers with satisfaction e.g. "the experience seeing a fallow strip within a field after the harvesting process..., there was alive of small animals, grasshoppers. They had survived. Without this fallow strip, probably they had died." "Pest control" remained unmentioned, but also benefits farmers especially that any walker-by can see the traps for the pest control experiment in their field.
The German focus group found that local communities main benefit from ES-friendly agriculture is that these farms can be used as compensation areas for new industrial areas. ES with main benefits for farmers includes Soil fertility and Pollination. Pest control brings benefits mostly for ecological farmers. Local communities benefit from hedgerows as the main protector against wind erosion, while farmers register losses due to shadow, nutrient and water abstraction and foliage on their yield.

Key points on beneficiaries and benefits derived from ESs

In farmers' minds, benefits were mainly separated as economic and non-economic. Economic benefits from ESs prove to be the most important factors in farm management decisions and a source of farmers' livelihood. Farmers tend to value only those benefits that are controlled by farming and they can actively control. It became also clear that *farmers are forced to make such compromise between ES-friendly farming and their economic viability*. Farmers often felt that *they have to defend themselves* by splitting their farming identities and local resident identities. Many focus group discussions were around how economic sustainability of farming contradicts with other (aesthetic,

ethical, ecological) benefits realised on various levels by various other beneficiaries. Frequently, farmers position themselves as *victims of the circumstances and blame others*, local or distant stakeholders (policy, conservation, tourists, investors, EU, etc.) for their losses. This is also a necessary phase in the process of group discussions that farmers tend to focus on common challenges that unite them: being victims of regulations, dependent on industry, market and expectations of society. Often farmers feel that they are *scapegoats for mistakes done by non-agricultural population*, e.g. when agricultural land is used for building construction, farmers need to compensate for the environmental destruction by providing nature conservation areas (Switzerland); or when SNH with beneficial ESs are not managed well by local authorities, it is the farmers who face problems in crop production (Italy); or when a municipality exchange areas to create a network of biotopes to be presented as compensation areas for new industrial buildings (Germany). Biodiversity policies have been criticised for focusing on regulating individual farms whereas ESs are created at the landscape and regional scale (crop diversity). Farmers also perceive a lack of understanding from society about their positive influence on the landscape. Still, their farm-level experiences point out their deep commitments for potentials for ES-friendly farming. Results show that benefits (and also costs) of ESs are more easily observable at the farm.

CONCLUSIONS

As for perceptions, we found that these are embedded in the lifeworld of farmers: we recorded rich and complex set of perceptions about ESs, linked to multiple attitudes and values. Some (e.g. directly economic) aspects of ESs are frequently considered, other cultural or holistic aspects are not at all mentioned. Case studies were heterogeneous according to farmers' knowledge and belief system which influence their perceptions and understanding of ESs and in this sense well-represent the heterogeneity of farming in the EU.
The mind-mapping exercise produced a comprehensive and detailed set of farmers' perceptions of most important local ESs. Perceptions are strongly embedded in the agricultural context; less abstract and more emotion-based, connected to everyday farming lives. It shows that farmers normally do not think out of their agricultural contexts. Essentially, the analysis on the interrelatedness of ESs shows that farmers perceive many interrelations with a focus on economic ESs. In fact, farmers recognise that their agricultural practices have a direct impact on ESs and ESs are calculated in their farming decisions.
Attitudes are ambivalent: they usually build on personal feelings and ethical considerations and at the same time use rational economic arguments. Farmers appreciated ESs in multiple ways (e.g. enjoying aesthetics and sense of place, benefiting from ESs, etc.) and valued it against the harm caused by pests, diseases and weeds (an indication of their success as agriculturalists). Positive attitudes typically go for yield and associated ESs including pollination; whereas negative attitudes are recorded towards Functional Biodiversity. Farmers have their own personal and ethical considerations, but these become *dissonant with economic rationale* and capacities in maintaining the farm. As a result, farming ideals and the real world requirements are often in conflict.
What constitutes ES benefit is very much *context-dependent*: ESs have different relative values according to the ecological and social conditions of a given case study setting. In essence, the economic are most appealing in farming. The perceived economic benefits are mostly related to farm management practices (especially how ESs relate to farm economics) and farmers' livelihood and identity as „Good Farmers" (see Burton 2004).
As a most important insight from these group discussions, it became clear that the concept of ESs is very well received in a given local contexts of farming. The valuation exercise also highlighted that the concept of ES is reinterpreted when farmers are involved in the discussions on the local scale. Therefore, understanding farmers' perceptions is crucial to invite them to maintain ESs. Furthermore, generating local level social learning processes (through extension and local study/action groups) can be as much important as supportive policies and subsidy schemes to shape the understanding of ESs. The exercise also pointed to the limits of monetary valuation in ES valuation, as they restrict benefits to economics which are seemingly important for maintaining the farm enterprise but less as an ideal for agriculturalists. Farmers mention 'yields' as the most important as this is the main success criteria represented by the CAP towards farming – however, according to farmers, this is problematic as yields are not equal with the money gained in exchange.

Reviewing the initial hypotheses

We established five working hypotheses for exploring the local understandings of ESs (H1, H2, H3) and the perceived value of ESs (H4, H5):

- H1: on the difference between scientific and lay definitions - There are no significant differences between the farmers' understanding of ES and the scientifically based definition of ES.
- H2: on the difference of organic vs conventional farming systems - Organic / low-input farmers have a more complex understanding (more solid knowledge) of ESs than conventional farmers.

- **H3: on the common points in understanding** - During the focus group discussions it is possible to develop a common understanding – acceptable for both local stakeholders and scientists – of ESs.
- **H4: on the appreciation of economic vs non-economic values -** Conventional farmers acknowledge more those benefits of ESs which can be realised in monetary terms (economic benefits), while organic / low-input farmers acknowledge more the indirect (non-economic) benefits of ESs.
- **H5: on farmers' perception of benefits** - The more local the level of assessment is the more benefits of ESs participants can perceive.

As a main result of the valuation exercise we summarise the key findings:

Hypothesis	Answer	Explanation
H1	confirmed	We recorded varying responses between countries with more acceptance of hypothesis and only some rejection.
H2	cannot reject	Most partners could not attract organic farmers to verify this. We recorded confirming responses from partners who had relevant results on this[3].
H3	confirmed	In all discussions with farmers it as possible to develop a common understanding – expect for one of the Italian groups.
H4	partly confirmed	Most partners could not attract organic farmers to verify this completely. Relevant differences found between old and young farmers, hobby farmers, etc.
H5	confirmed	Local benefits found more important in most countries.

Table 7. Summary of key findings

Results with a detailed explanation from case studies:

H1

- **DLO – confirmed** – Farmers and scientists, in general, had the same understanding of ES. However, the understanding of SNH by the farmers was clearly related to their daily work in the orchard and the economic situation of their business. In contrast, scientists had a broader understanding of SNH, also were not directly linked to the farm business.
- **UK – confirmed** – Farmers understood the meaning of each service… also took a very personal approach to considering the ES. This hypothesis was largely supported. There were few significant differences between a farmers understanding of ES and the scientific definition. There was some scepticism among farmers over how much service is provided (e.g. whether natural enemies can control pests effectively) but in general, farmers understood the meaning of each service. Farmers also took a very personal approach to considering the ES whereas the scientists were more detached and tended to think at a larger scale.
- **IT-PISA – rejected**: no clear perception of the benefits by farmers; This seems not to be true because farmers have no clear perception of the benefits they or society derive from the semi-natural habitat around their fields. They do have a negative perception related to wildlife (wild boar and birds) that damage their crop, bad management (water courses that do not drain well and flood their fields), and woody plants that hinder the passage of machinery (because often fields are small due to dense drainage channels).
- **IT Olive**: confirmed. Farmers recognise the service but acknowledge that without them, the service would not be there.
- **UKL – confirmed,** no differences. In general, there are no significant differences.
- **SZIE – Confirmed** - Farmers understanding is problem-focussed. There were no significant differences between the farmers' understanding of ES and the scientifically based definition of ES. However, when looking at the pictures farmers rather linked the showed object to the problem than to SHN and ES. Some farmers started to speak about damage caused by wildlife, which could be interpreted as a disservice, but hunters and statistical data show that wildlife population, thus damage caused by wildlife is low in the region. This was the situation in the case of "water holding

[3] A possible future improvement of our research could be to enlarge the sample and organize focus group discussions for organic and conventional farmers from various farming systems.

capacity" as well. Farmers talked a lot about the problem caused by inland water but it was hard to link to any ES to them.

- EULS – Not rejected. Farmers are well aware of interactions and trade-offs among ESs. Our results neither reinforce nor reject this hypothesis. There were some differences from time to time, but these differences were not that significant. Scientific definitions often leave profit as the last thing to consider, farmers, however, have to make a living. Their aim is after all to get a good yield, but they do understand, that it is impossible to reach this goal without taking other ecosystem services into consideration. They are well aware of the fact that all these services affect each other, and that they all have both positive and negative sides to them.
- FDEA-ART- Confirmed. But differences in assessing importance and interrelations. We confirm this hypothesis. The meaning of the discussed ESs was the same for farmers and scientists. However, there were differences in assessing importance and relations of ESs between farmers and scientists. Knowledge, experiences and contacts with ESs in everyday life are different in the two groups. Whereas farmers focused primarily their personal contribution to ESs and benefits of ESs for their work, scientists discussed relations between ESs, their complexity and measurability.
- FR – rejected. I think that the results obtained from the scientists and the vine-growers are different according to the ES which is defined. Pest and pathogen regulation was seen as very important for scientists whereas vine-growers were not really convinced that biodiversity and its protection could suppress. This perception depends on the farmer, and the point of view was different between organic, and conventional or integrated vine-growers. Organic farmers were more convinced by mid-term or long-term positive effects of the reduction of pesticide use and the preservation of SNH, even if they were aware that these processes can be of interest, not all years but helps to reduce the mean abundance of pest species.

H2

- DLO – confirmed as traced more complex understanding with low input. In our focus group, we had a homogenous group of conventional farmers. Here we could not compare organic with conventional farmers. For the interviews, we also exclusively visited conventional fruit orchards, but here the participants were quite diverse in their way of managing the farm. Two farmers could be called low-input farmers and they indeed had a more complex understanding of ESs.
- UKL - cannot confirm or reject. Farmers have a solid knowledge and a complex understanding of ESs. This hypothesis cannot be verified. All interviewed farmers had a solid knowledge and both organic and conventional farmers had a complex understanding of ESs.
- SZIE - cannot confirm or reject – try with increased number of participants? We achieved to make an interview with only one farmer, who was an employee of Tarnamenti 2000 Ltd, active in the region. We do not observe a significant difference between his and some of conventional farmers' approach. One farmer who is an employee of one conventional farm (F3) was quite opened towards SHNs and ESs. Both farmers have their own fields as well, and doing farming on their own as well. However, we have a feeling that in the case of increased number of participants the hypothesis will be true.
- EULS – yes, older farmers have a more complex understanding. As the participants were mostly conventional farmers, we cannot give an answer to this. However, in general, it seemed that the slightly older generation has a more complex understanding, the host being the most considerate (of course within reasonable limits). In terms of plant protection, he has always been cooperative with the Estonian University of Life Sciences and he is planning to keep on doing so in the future. Which is undoubtedly useful for us, through him we can convince other farmers to cooperate, they are listening to him.
- FDEA-ART- yes, the organic farmer had a more comprehensive view. Only one organic farmer (F8) participated in the focus group. Indeed, it was he who mentioned some points, which indicated a comprehensive view, that were not touched by the others: "Both ("Yields" and "Recreation, aesthetic value") are needed, they have to complement each other", "To

maintain soil fertility, fertilization alone is not enough", "greening during winter time", "soil organisms", "balance", "erosion mitigation due to green area", "The promotion of beneficial organisms will influence the yield. It won't have the same effect on different crops. But for some crops it might be of high value" and "We can promote beneficial organisms with areas reserved for promoting biodiversity".

- UK – cannot confirm or reject. There were no organic or low-input farmers in our group.
- FR - yes. Most of the vine-growers were organic farmers or very close to this management system. The only participant really classified as "conventional vine-grower" was very interested in the discussion and the points raised by the others even if his remarks were more focused on the aspect of aesthetics related to the urban pressure (aesthetic of agricultural landscapes with urban buildings) rather than the potential effects on soil functioning or pest control.
- IT - Olive: cannot confirm or reject. We cannot say anything about this hypothesis because we did not have a grouped of mixed farmers. We tried to have a homogenous group of farmers in the focus group.
- IT – Sunflower: cannot confirm or reject. We cannot say anything about this hypothesis because we did not have a grouped of mixed farmers. We tried to have a homogenous group of farmers in the focus group and they were all conventional farmers and contract workers.

H3

- FR – Yes, and I was very surprised by the fact that they were already very aware of the vocabulary used even if the vine-grower 3 was clearly less informed about these concepts.
- UKL - confirmed, no problem to develop a common understanding. As there were not many differences in the understanding, it was no problem to develop a common understanding during the focus group meeting.
- DLO – confirmed, but aesthetics/recreational value was contested. We partly confirm this hypothesis. We could come to a common understanding of the importance of emission control on the one hand. On the other hand, we did not develop a common understanding regarding "aesthetics/recreational value" in the focus group. We as scientists emphasised the importance of a positive image of the fruit production business, which can be supported by the integration of SNH on the farm. The farmers, in contrast, did not feel well understood by the customer: "The customer claims fruit without residues, but we have no other option than applying pesticides for high-quality fruit production." Farmers feel criticised in this way and are not encouraged to do any effort to please the customer.
- SZIE – confirmed, open and fruitful conversation – with complaints e.g. about drainage. There was no problem to have an open and fruitful conversation with farmers about SNHs and ESs. However, most of the farmers when saw the pictures started to speak about the problem itself without linking it to SNHs and ESs (e.g. talking about inland water problem- the necessity of draining and drainage of fields were mentioned). It was the same during the focus group discussion as well.
- EULS - reinforced. Acknowledge that beneficial ESs can have negative effects on the stakeholders. This hypothesis has been reinforced. This meeting made us be more aware of the economic sides of farming and ecosystem services. We could realise that what we think is beneficial can actually have a negative side, too, and vice versa for the stakeholders. So, we did manage to develop a common understanding.
- FDEA-ART- yes
- UK – confirmed. A common understanding was reached quickly on all ES except Functional Biodiversity which was discussed at some length before the group felt comfortable with it. This may have been because it incorporated several elements, is more complex and may have multiple benefits as well as some potential disservices. The composite image illustrating the Functional Biodiversity also showed diverse images and this may have encouraged debate and a need for clarification.

- IT – Olive: confirmed. I guess in this case we could, especially because already from the start we were aware of their situation and the olive growers on the Mountain are very aware of the territory they live and work in. It clearly emerged that they work and pay money to maintain the territory and the services it provides. We tried to show that if we can quantify the value of all the benefits the Monte Pisano offers to society, besides producing olive oil, this may help to have support from local policy makers.
- IT -Sunflower: rejected. The whole issue of semi-natural habitat remains vague to them and the only habitat they showed some interest in at the end were the cover crops Andrea De Angelis promoted as effective against soil erosion/nutrient leaching and for soil organic matter conservation.

H4

- FR – cannot confirm. No clear differences between the two groups about the perception of ES as indirect or direct benefits. There were no clear differences between the two groups about the perception of ES as indirect or direct benefits. As already showed before, the aesthetic value is clearly a non-economic benefit of SNH at the landscape scale but the vine-growers see it as an economic benefit for on-property sales.
- IT – Olive: reject, it is hobby farmers who perceive the indirect benefits the entire territory gives to society. They do not feel they receive anything from the territory, besides the joy of living in it.
- UKL – partly confirm. Indirect benefits were less acknowledged. Organic farmers tend to better acknowledge nature conservation. In the interviews, ESs that had more indirect benefits or benefits for the community rather than for farming and where there are no monetary costs for the farmers were less acknowledged. The only ES services that organic farmers acknowledged much more than conventional farmers was nature conservation.
- SZIE - cannot reject or confirm. The difference was not observable. Ownership counts: owners who cultivate by themselves acknowledge more the non-economic benefits. Since we happened to ask only one low input farmer this difference was not observable. There was only one farmer who was really averse to SNHs. However, when talking about personal relations he was opened as well. In my opinion the difference between understandings of ESs depends on whether they are owner of the cultivated field and doing field cultivation by themselves (they acknowledge more the indirect non-economic benefits of ES) or are they just cultivating (economic benefits dominate) the filed without any emotional and remembrance relationship (e.g. my grandfather's homestead, when walking with my grandson).
- EULS – not confirmed, the only difference between the older and the younger. We can only say that there has been a slight difference between the older and the younger generation.
- FDEA-ART – Cannot confirm. Economically orientated (the beauty of a highly productive area) vs non-economical view (retirement, future generations moratorium on GMO). There were no clearly distinguishable groups of farmers regarding their acknowledgement of monetary or non-monetary benefits of ESs. However, they gave statements which would allow to place them along a gradient of the two extremes. For example, F1 expressed an economically orientated view: "I like the beauty of a highly productive area", "cash", "all want agricultural yield", "chance of genetically modified organisms". F2 expressed a non-economically view: "For me, it ("Biodiversity conservation") has an idealistic value", "I don't want to retire being complicit in bringing to extinct an animal or a plant species", "Who knows if future generations will need such organisms?", "I supported the vote for the moratorium of genetic engineering in our region, and we won it", "For me, the idealistic value is important, not only the yield", "Subsidies for areas reserved for promoting biodiversity are important", "Society has to appreciate the non-monetary values that agriculture provides and remunerate it".
- UK – cannot confirm. We had few differences between our farmers, none of whom were organic or low input. In general, the farmers were economically orientated in their assessments so that even the value assigned to recreation had its roots in the economic

returns that might result from the increased goodwill. However, there was some sense that there was an obligation to provide something towards the well-being of local people and one farmer said that conservation of pollinators and pollination was the 'right thing to do'.

- DLO – confirm. We confirm this hypothesis, taking into account the two "low input" conventional farmers in our interview group While the focus group indeed was mainly economically driven, the two low-input farmers also do efforts as they simply enjoy it.
- IT – Olive: cannot confirm or reject. We cannot reply to this question because we had only conventional farmers. However, we can say that the hobby farmers on the Mountain, whether or not organic, all perceive the indirect benefits the entire territory give to society. They do not feel they receive anything from the territory, besides the joy of living in it.
- IT – Sunflower: cannot confirm or reject. We cannot reply to this question because we had only conventional farmers. However, the farmer who had studied agronomy at the university of Pisa is passionate about cover crops and no-till systems because he sees a clear benefit for sustainability of soil fertility. Some of the other farmers admitted in the end that maybe hedges are far away from the crop and planted with commercial species could be interesting.

H5

- FR – reject. Except for quality of the yield, all the other ES in which they are interested are visible and understandable at larger spatial scales and they are very aware of this point. I contradict this hypothesis. I think that most of the vine-growers, maybe because of the spatial upheaval of the vineyards (most of their fields are dispersed in different localities), easier perceive the landscape aspect and scale of their activity. Except for yield or maybe more the quality of the yield in each of their fields, all the other ES in which they are interested, are visible and understandable at larger spatial scales and they are very aware of this point.
- UKL – confirmed. ES with local benefits rated higher. CO2-sequestration, recreation and nature conservation are less important. Doubts about SNH effect on soil fertility. Ecosystem services that provide local benefits on the fields for the farmers have been rated higher. Whereas ecosystem services like CO2-sequestration, recreation and nature conservation have been overall less important. But the farmers know these ecosystem services. We do not know if they had mentioned them if we had not used the ES pictures. That soil fertility can be provided by adjacent semi-natural habitats was doubted, the fertility management on the fields is much more important.
- SZIE – confirmed. Local benefits rated higher. Broader community benefits attached to hunting. Farmers were able to see benefits provided of SNHs if these services are observable on a local level. On the other hand, the broader community was mentioned four times mainly regarding "cultural capacity" service. The most overviewed opinion on the benefits provided for the broader community was mentioned, when talking about economic benefits provided by SNHs regarding habitat for wildlife linked to hunting.
- EULS - confirmed. The own land is a priority; willingness to think globally. This hypothesis has been reinforced. After all, your own land is the priority and every farm is different in one way or another. Although, that does not mean that they are not willing to think globally as well.
- FDEA-ART- rejected - locality was of minor importance. Difficult to perceive "Biodiversity conservation", "Pollination" and "Pest control". We contradict this hypothesis. The locality of the assessment level was of minor importance for the farmers. However, the likelihood to perceive an ES highly affected its priority for farmers. "Yields" was the most important for them. This ES is the aim of their work, they plan and calculate, invest and count the yield. "General level of soil health", "Erosion mitigation" and "Water retention capacity" are visible signs that effect the yield. Farmers are used to interpreting these signs and adapt their management strategies. More difficult to perceive are "Biodiversity conservation", "Pollination" and "Pest control". We assume that farmers did not give high priority to these ESs because they are difficult to see and measure. Knowledge of farmers about species was sometimes low. So, they would not automatically recognise rare species (plants or birds) on

their area. Furthermore, effects of pollination and pest control are hard to measure. Farmers would be interested in results but they can't assess the benefit of such ESs, normally.

- UK – cannot reject or confirm. Difficult to say; the larger picture was not on their minds only implicitly. This is difficult to assess from the session we ran. Certainly, farmers were focussed on local effects, in terms of yield and also in terms of recreation. The larger picture was not on their minds. We did not explicitly discuss the scale and the farmers were orientated locally. However, farmers did allude to national priorities when discussing environmental stewardship, 'we sort of feel we are being told as an industry that we need to be doing more to replace habitat loss of flower meadows and so on' but they then felt that this should be incentivised 'to give people confidence you need to have an incentive to do it.'
- IT- Olive – cannot reject or confirm; still, local farmers are left out of local level decisions. All participants in the Focus group were local farmers. We can say that, whatever it is local politicians and land managers of the community do, they are not very good at involving the local farmers or in communicating this to the local farmers.
- IT – Sunflower: cannot reject or confirm. All participants in the Focus group were local farmers. We can say that, whatever it is local politicians and land managers of the community do, they are not very good at involving the local farmers or in communicating this to the local farmers (same as for olive grove case study). Farmers obviously have no idea about the problems local authorities have in managing SNH. Farmers feel abandoned by local authorities in this regard, and they also feel that policy makers at national and European level have no idea about farming and needs of farmers.
- DLO - confirmed – perceive through their orchard and linked the ES to their business. We clearly confirm this hypothesis. The farmers from the focal group were focussed on their orchard and the direct surrounding. Concerning the ES, they directly linked the ecological service to their business.

Reflections and recommendations

The main purpose of our methodology was to clarify how *farmers think* about a scientific term. More specifically, it aimed to determine the private and public economic benefits, non-monetary value and socio-economic value of selected ecological services in the case study regions with appropriate standardised methods. A further ambition was to enhance the project's *social relevance* and stakeholders' engagement through qualitative and participatory research techniques and help stakeholders recognise the results as their own. We also wanted to benefit from inviting farmers to group discussions who got already involved in the QuESSA project and also give the opportunity to local organisers to attract farmers cultivating the same landscape as a wider basis for recruitment in their fieldwork.

Therefore, we developed a process to be a strong *promoter for uptake of SNH management* aimed at increased ES provision. It comprised of Training workshops with case study partners planned as a side event of the meeting in Gödöllő. Then preliminary interviews were planned with farmers in the case study areas to gain a list of priority ESs and fuller understanding of farmers' views on SNHs. As a main focus of the valuation, focus groups were planned in each case study areas with farmers to initiate discussion around a visual exercise to re-represent the main ESs and further explore benefits of ESs. This exercise was expected to finish from January to March 2014, but many partners could not fit this into their planned schedule and claimed that it requires significantly more time and resources. As a final move, we planned another round of questionnaires for pairwise comparison but this was re-planned in the second year to shift more focus on the lifeworld of the participating farmers. The main reason for this was the lack of available time and resources from the project partners' side. Partners also wanted to concentrate efforts on interviewing and focus groups with farmers and fully benefit from gaining deeper insights on farmers' engagement through the discussions. Furthermore, building on the results of preliminary interviewing the focus groups already helped the opening up a discussion

on the range of benefits and highlighted the importance of ESs by understanding how farmers attribute non-monetary values to ESs according to their contradictory interests.
The main strength of this qualitative process was to conceptualise the relationship between results and their local contexts. As for the generalisability of our results, it entails that the research is valid for Quessa case study regions, and can be generalised only to farmers based on the representativeness of local focus groups. Principally, the results are indicative of farmers' thinking and approach towards SNHs. The outcomes of group dynamics and interactions among farmers or with researchers clearly provide lessons for cooperative, participative research settings in general and especially for the growing body of qualitative non-monetary ES valuation studies. As we presented in the Methodology chapter and the context analysis of the case studies we expected some slight differences in data collection and analysis among case study areas. In sum, our results are limited in scale and context mainly because of resource constraints. Thus, there is a need for more research in order to broaden the scope of the findings and to deepen the understanding of the local contexts. All in all, much effort would be needed to understand farmers' worldviews and interests to better approach policy design, elaboration and compliance to the rules.
As a primary concern for farmers, we identified economic viability, profitability, the treadmill of agro-food commercialisation and being driven only by costs and benefits, when talking about ES-friendly management. The valuation exercise opened the door between farmers and researchers to learn about how to survive as farmers in the current economic situation. It all seems that all other benefits beyond the 'economic' are often conceptualised as 'pure aesthetic' or just abstractly 'good' for pest control or pollination, soil health. Being an inherently value-laden concept, ES as a term is (mis)leading farmers to think about services they receive. During the discussions, they reinterpreted the term and attributed values in close relation to their everyday life and personal experiences. Essentially, the discussions were focussed on capturing the understanding of the most important ESs, and as Table 6 on the top 5 ESs shows most often the potentially difficult aspects, as well as aesthetic and cultural aspects, are left out and were therefore not discussed or avoided. Furthermore, staging the discussions to elicit abstract concepts also implied that people were inclined to share fewer feelings about the beauty of the landscape or did that only in an abstract, aesthetic sense. Still, the opening questions about farmers' preferences for landscapes generated a discussion about "Recreation, aesthetic values". The discussions about (necessity of) SNHs (hedgerows, woodlands, field margins) triggered farmers to share mostly ambivalent feelings, uncertainties about maintaining the beauty of the landscape where they live and work, and also about the value of SNHs. ESs provided by SNHs were often "out of their thinking" and in some cases we identified a missing link in translating values in SNHs into ESs and values for farming. In general, the discussions managed to build this bridge and reach a common understanding of the concept to include ecological, emotional and utilitarian aspects.
Partners' reflexions on the valuation process show that it provided a challenging and interesting exercise that very well embedded the results from an ecological investigation in their field works. Partners found the coding as the most demanding part of the exercise (especially determining the relationship between the codes was complicated) which in turn resulted in substantial insights based on farmers' own words. In this way, the exercise helped researchers to fully grasp farmers' emotional links to the landscape through farming and landscape management (most typically to the flat or mountainous area, typical built environments and infrastructures, or working in nature as such).
An important lesson to consider for policy would be to re-evaluate SNHs management that requires sufficient subsidies for greening. Monetary incentives are also required associated with direct involvement of and awareness-raising among farmers in co-designing ES-friendly agricultural policies. The results also pointed to the need for establishing participatory farmers' *training* and action groups to share knowledge on agro-ecological systems and empower local farmers to adopt better agricultural practices. As many reflections from participating researchers suggested, clear information on SNHs and ESs understandable for lower educated farmers would be a minimal background to engage farmers in ES-friendly agriculture. Organising training (in particular cooperative and participatory settings to share experiences) could also be a way to influence old beliefs and routinized farming practices.

Resource use

As for the resources required by the qualitative assessment we investigated the following elements:

- working hours used for the preparation (reading the manual, participating at the training, etc.)
- working hours used for organising and facilitating the focus group discussions
- costs of the focus groups (travel, room and equipment, snacks, drinks etc.)
- working hours used for transcribing and analysing the focus group discussions

	Switzerland	Italy	Netherlands	Estonia	UK	Germany
Preparation	46 hours	16 hours	44 hours	Training 4, manual 40 interviews: 24 h; interviews: 8 h.	12 hours	10 hours
Organising and facilitating	38,5 hours	8 hours	10 hours	20 hours	4 hours	15 hours
Costs of the focus group	CHF 29.10 for drinks	EUR 50	Euro 20	organised the meeting at their office provided the place and the technical things	farmers paid their own travel, no cost for the room, only snacks/drinks for 15 Euros	300 euros
Transcribing and analysing	39.75 hours	36 hours	20 hours	40 hours	20 hours	16+60 hours
Writing the report	18 hours		17hours		16 hours	20 hours

Table 8. Summary of resources used for the valuation study

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