Community Valuation of Eco-System Services as Social Capital Creation: On Joint Participation in Farming System, Landscape and Project Analysis

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Abstract:

This paper focuses on the idea of merging the concept of farming system analysis (FSA) and ecosystem services (ESS) at a landscape level for community valuation and social capital creation. It offers a conceptual framework for participants to appreciate a landscape as unit of providing eco-system services ESS and becoming a joint asset rendered as social capital. Beside farmers non-farm concerns in land use of nature conservation and improving nature provision for cultural landscapes are integrated. We show how to improve sensitivity for ESS at landscape level under collective decision making processes. In a first step we clarify the issue and acquaint the reader with discussions on the importance of ecosystem function (ESF) and services (ESS). Then well-being is acquired by a group of users as benefits from a self-reliant cultural landscapes being an institution and semi-autonomous unit; hence we surpass methodological individualism. Secondly we inform about deliberations on possible ways for the inclusion of ESS in landscape management, currently popular in upcoming projects and policies. The ESS concept shall serve as a vehicle to promote “more conducive” land use systems and we look at analyses broadening the concept of farming as system analysis to landscape analysis in sense of balanced needs. In a third step, we emphasize landscape aspects (features) for ESS provision, and finally come to possible responses by users. The aim is to create new insights by looking into ESS concepts and scrutinizing them for landscapes. The principal message is that there is scope for a new synthe-sis, called landscape system analysis (LSA). An advanced LSA requires integration of ESS as public management, inclusion of community concerns, and promotion of farm related ESS.

Keywords: *Eco-System Service, Farming System Analysis, Landscape Analysis*

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1 Introduction

Farming system analysis (FSA) has been a popular concept over the last decades; but eco-system services have not be integrated sufficiently. Also, we find different variants of it (in French: the "System *Agraire"* concept, in Anglo-Saxon: "peasant studies" or "agrarian studies in rural economy", in German: "*Agrarverfassung"*, etc.; however for a recent overview on developments, cultural differences and expansion see: Cochet, 2012). Yet FSA is open for services provided communally. FSA tries to integrate natural conditions as well as agronomic and socio-economic aspects of farming into a holistic view of rural life. (For being brief, we work here with FSA as unified term though the many aspects and variants mentioned by Cochet are to be taken into account.) FSA is considered as a high-quality tool (Collinson, 2000) with broad aims and the major aim is to find pathways for developing new options for rural population plagued by industrialization of agriculture as well marginalization of rural areas. Yet it also can integrate social capital indicating the knowledge gained from eco-system service reckons. In this contribution the focus is on structural change and needs to further include major findings from ecology in regards to eco-system service (ESS) provision and making it a capital basis.

We will argue that new developments in ecological foundation of land use options integrating eco-system services (ESS) are equally important as well as behavioural aspects of farmers on inclusion of ESS. An emphasis is on knowledge beyond individual farms. As recent studies from different places in the world have shown rural populations, particularly poorer segments, rely heavily on common pool management (CPM and ESS: MEA 2005). But also rural populations have found different institutional and organizational modes in order to manage land based on ESS and get this as social capital. For instance, ecological main structures (EMS) which go beyond farms enabled them to cope better with degradation (Perfecto et al. 2009), but it requires public action and recognition of ESS as social capital. Farmers may suffer chiefly when there is strong resource extraction and decline of soil quality and natural fertility, and hence they seek CPM. Seeking is one side of the coin, getting the other. Additionally, as many rural inhabitants not only rely on food production and raw material deliveries (but also tourism, amenities, dwelling in rural areas, etc.) these aspects have gained importance (Hebinck et al. 2001). In the end, most of analyses are already at landscape level. Some scholars have already opined about Land-Use-System-Analysis (LSA: Veldkamp and Lampin 2001). A driving force behind the need to broaden concepts is a debate on modes on establishing links between ESS and well-being (MA, 2005).

Based on this short introductory discussion, we might suggest two queries: (i) How can one integrate ESS better in knowledge and valuation and (ii) how can we better delineate management options derived from ESS (both, as part of a Landscape System Analysis LSA and Farming System Analysis FSA)? The underlying hypothesis is that most ESSs' are primarily found at landscape level, and are not directly related to farms, so we need collective valuations (TEEB, 2010). In fact, it needs efforts of better link ESS to landscapes to reach a new synthesis and make functional links between provision units and farms visible in a system approach. As the economic background is that ESS are getting scarcer and have come under threat (due to problems associated with the common pool resource management issue: Sandhu et al. 2012) this needs to be addressed. So communities shall sponsor ESS provision through payments for ESS (PES: Stallman, 2011; but this is only one way) based on joint valuation; notably at landscape level policy should seek joint efforts through PES to systems (this is a way, we will investigate).

In this regard the first objective of this contribution is to discuss consequences of the ESS provision concept for farming-system-analysis (FSA). In contrast to the paper of Cochet (2012), which has more a social science focus, the ecological aspects are emphasised here. As a second objective we pursue the idea that institutional and organizational choices as well as their consequences are likewise a core problem of ESS provision, vice versa. We ask how institutional choices can become interwoven with the analysis of ESS at community level. Hence, the paper is not about empirical suggestion (making links visible), but rather argues in favour of an integration and syntheses of concepts of ESS and community based on rules and regulations, particularly looking at institutional perspective about obligations and rights. We discuss how to integrate them in landscapes "design" for species richness and ESS generation as well as provision of service (Dauber et al. 2005). Today, ESSs are already important aspects for many rural communities, for example farming with high nature value farming is one (HNV: Andersen et al, 2003). We will expand on that and will seek generalizations.

The paper offers initially a short definition of FSA in as much as it is necessary in our context. Secondly, we will clarify the term ESS and thirdly work on the term "landscape" as a link between natural and social science. Fourthly, the consequences for landscape planning are discussed and, finally suggestions are offered for landscape system analysis as synthesis of EES and FSA.

2 Farming System Analysis

To accomplish an integration we need a better understand of FSA. Farming System Analysis (FSA) is a very broad concept from a methodological point of view (Gibbon, 2012). Yet it has not been sufficiently integrated in valuation of ecosystem services. It can be either an analytical tool, i.e. used in positive analyses, or a normative approach, for instance by strongly pursuing the intentions to delineate improvements for rural livelihoods. This requires valuation. In this article we follow a normative approach suggesting that FSA analysis shall gain from inclusion of ESS in improving livelihoods and create more well-being at community level. Hereby we have to deal with a new interfacing between life science and social science (Cochet, 2012, i.e. follow development orientation and integrate institutional and economic perspectives for making suggestions) on how best societies could dependent on ESS. At the core one must ask how ESS provision can be organized and put into value (capital). Potentially drivers in landscapes are to be identified from historical and existing example (Fairhead and Leach, 1996). The hypothesis is that

FSA und ESS can be merged to community landscape (level) to create an impetus of change. In principle we suggest to strengthen the system perspective of FSA at landscape level (Ison, 2012; Cochet 2012), looking across boundaries of farms.

The question, to be addressed, is: how can FSA draw inputs form ESS research at landscape level and integrate them into projects of value creation? In fact, there is already an emerging debate on reshaping boundaries between farms, farming systems and the environment (Bellon and Hemptine, 2012). The emphasis is to do it at the level of: (i) need for knowledge to understand how nature provides ESS based on ESF (see pollination). (ii) Need for new socio-technical solutions which partly "re-invent" peasant behaviour (i.e. facilitate an exposure to land conservation). (iii) Circulation of mode of knowledge as based on value oriented priorities for management (using ESS as resource instead of inputs) and (iv) agro-ecology beyond profits (this a subject of what is called "green agro-managerialism": Bellon and Hemptine, 2012, p. 319-320). These authors admit that "Agro-ecology" Research AER and Farming System Research FSA are not "straight forward" and different concepts (Bellon and Hemptine, 2012 p. 320), but should let to nature inclusion. We will start by describing agro-ecological concerns as basis and ESS provision on community basis and valuation and then establish links between ESS, landscape and FSA.

3 Eco-System Services and Farmers

For almost three decades Eco-System-Service (ESS) provision has been a vibrant concept in ecology. Although there is still a debate (Dempsey and Robertson, 2012) on its correct application, especially in applied research (vs. ecology and economic science), the ESS concept has gained high levels of attention (Engel et al., 2008). It is linked to modes and intensities of farming (Beckmann, et al. 2019) and establishes dependencies of farming and farming systems on nature (ESS). For instance, in old and traditional practices, taking intensive care on fertility of nature (soils and prey-predatory equilibria) paid off in the long run (Bauhardt, 2014 for renewed talks). If dependency on non-substitutable ESS (via human activities) exists then on local nature; habitats and landscape strongly determine limits of farming systems. Maybe, substitution of pollination by man is unthinkable in reality (Daily, 1997) or only at high costs and this is important for valuation.

In scientifically oriented concept outlines (like for pollination) it is easy to demonstrate roles and problems of ESS in communities (Winfree et al. 2011) and it is said ESS is the most important resource; even more important than human capital. But do farmers value and are willing to pay for it. Pricing for the service is low. Since well-being (survival) of species (bee) is not controlled fully by humans (Jauker et al. 2009), the pollination service depends on both, keeping and natural habitats. We need common values on that. The wild is usually excluded by farmers who count only efforts. Then assertion of new technologies is important and these must be linked to extended concepts of providing ESS (Vandermeer and Wright, 2009). Unlike production process in factories bees do not live in isolated locations which are well defined and controlled in terms of

in- and outflow of forage and products. Bee keeping, as example, characterises a human-nature-production interaction, the system is vague, and bees are embedded in nature not in the “firm”.
So what is the role and value of nature (ESS, again insect pollination as example)? Even if no private bee keeping occurs, it does not mean that no service exists. Agreeing with Costanza et al. (1997) the economically measured value of pollination is meagre. Another issue is how much of ESS provision is related to specific species contribution (for example ants are difficult cases; ants are “farming” whole landscapes by recycling organics and farm ESSs are secondary based on “supportive” ESF: Dauber et al. 2008)? This is prone to collective assertion. Next, the question arises: how should we see the linkage between managerial elements (changeable by farmer) and provision of ESS (nature), only as bookkeeping or set task to assure provision?
The science-based concept “ESS” is not new (Daily, 1997); but it creates fresh thinking if it also creates quarrels as part of social valuation in groups (Strassert and Prato, 2002). The speaking in this discussion on “landscape (ecology)” requests values for habitats. Nature normally is founded at large scales (more than on farm level: Nelson, et al. 2009). To obtain a true value (collective value) of inclusion of services (such as soil nutrition enrichment, pollination, natural pest control in farming, etc. at landscape scale) combinations of ESS, farm areas, landscape elements, etc. are chief and farm designs are needed beyond farm. The literature has revealed it gets very complicated to manage land commonly (Meffe et al, 2002), but no other chance! Whether management emerges freely or needs control and CPM is a big issue, yet to be explored.
Again, it is difficult to demarcate a borderline between farming; also to distinguish ESF and ESS from inputs, and separate them from other farm activities (Stallman, 2011). ESSs are part of two systems (ecological and social) and we have to study interaction! At least it has been shown that the landscape level (and management) matters for ESS provision (Dauber et al. 2005); but what is with the values? We can conclude: from the need of joint management we should derive a value of ‘special farming system’ for ESS which recognizes landscapes and *vice versa* address habitats by landscape elements. For example, in the work of Banks (2002), a list of items is given for landscape elements such as fencing, hedging, walling, woodlands, moors, wetlands, etc. (This he did for Wales, but is it also commonly applicable.) and they need special attention in valuation.
Following the argument that the management of landscapes for ESS provision has to be jointly conducted by farmers, landscape characters emerge as criteria for community valuation. Looking at current deficits in ESS management we need collective action and management (Stallman, 2011; Wossink and Swinton, 1997). Creating interfaces and their values is important for integration and linking ESS to farms (Dyver, 2018). It is workable with hedges, their habitats and nets.
The next hypothesis to be investigated is whether farmers voluntarily contribute to ESS provision (again as example: hedges, eco-nets, EMS). Farmers deliberately can shape their environment (or not: Perfecto et al. 2009). Institutional failures of conservation and ESS deficits (Knieriem,

2002) emerge frequently. But farmers only use ESS if they live in conducive, social surroundings and see the ESS needs as collective running which is part of their social type of valuation.

4 Landscapes as Perceived by the Economics of ESS

Landscapes and their appearance can be considered as an intermediary between ecosystems and human systems (Jongman and Pungetti, 2004). For promotion of ESS provision we suggest a landscape system analysis (LSA) which has a focus on instruments such as ecological main structures (EMS, a word coined by Oskam and Slangen, 1998 or eco-nets: Jongman and Pungetti, 2004). The idea of EMS and ESS in landscapes is not new, though it requires a modern perspective. Facts and lessons learnt on ESS have formed the history of farming and FSA over centuries (Grigg, 1974; though it was not named this way). For example pest pressure reduction, etc. accordingly worked with particular EMS elements. This was mainly evolutionary, but partly deliberate and sometimes even based on authorities. Examples from Denmark show (Kristensen 2001) that interactions between willingness of farmers to invest in nature, collective action and authorities (as hybrid institutions) can offer stories of success. As further example, the three-field-system in Middle Ages was an interesting creation and experiment to generate ESS and soil fertility at landscape level (Baker and Butin, 1973). At community level farmers for all times contributed to spatial outlets. This may sound trivial, but it helps to better understand ESS provision, which usually heavily depends on spatial outlet (Bamiere et al. 2013). Conservation as well as ESS prerequisite must fit in fields and nature structures. To illustrate the case: For our current discussion we could compare a traditional landscape and corresponding farming system to confront the traditional with a modern landscape (Fig 1 and 2: Nuppenau and Helmer, 2007).

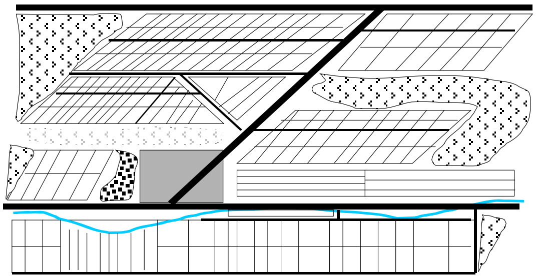

Fig. 1: Modern land use structure

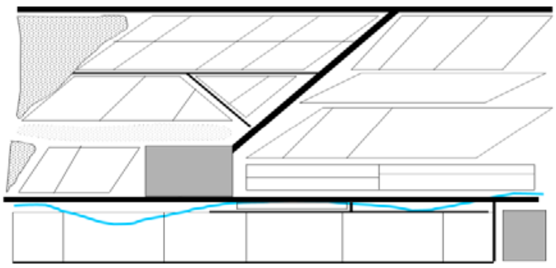

Fig. 2: Traditional land use

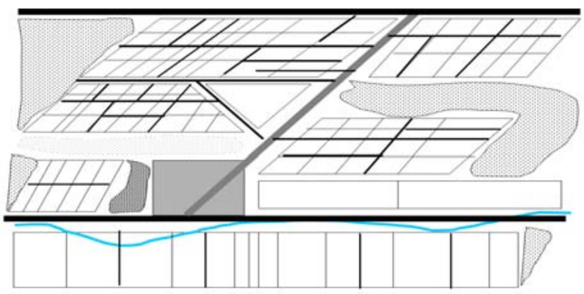

Fig. 3: Landscape compromise including an eco-net as main-structure

Next hedgerow systems as, for example, developed in Northern Germany (Knauer 1993) and Denmark (partly under pressure of landlords: Hybel and Poulsen, 2007) have to be mentioned as a strong CPM. But it has not only a physical facet. The social aspect is it is a public good and, at landscape level, an authority (an institution) was needed to create cooperation (here landlords). Coercion was needed (on needs for cooperation/institutional gaps: Hagedorn, et al. 2002)?

Nature elements in landscapes usually follow a complex modelling. Perhaps it can only be carried out by a combination of ecological and economic models (Fohrer et al. 2002) and regulation. As example, in programming research has tried to add field margins (Wossink et al. 1998) and created a nature matrix. But landscape-ecology-design is still complex. Especially in systems which need melioration, control of contours, protection against wind erosion, etc., decision making of farmers on field levels and decisions on landscape (i.e. field structures) are joint (Veldkamp, 2011). At this stage we should not forget that ESSs are still competing with industrial inputs and that ESS provision is embedded in farm policy. The farm policy of the last decades was pro-external inputs (EU Parliament 2013) and national policies (which follow EU, but have scope for modification) offer a shift to “green agriculture” which can be observed as public value shift.

Most critical, from the ecological side it has been proposed (Forman and Zonneveld, 2011, recently; and by Haber, 1992, already some time ago) that a certain land percentage (more than 15%) should be devoted to landscape. Many proposals have been made and farmers should participate (ec-europe, 2011 and Jones and Stenseke, 2011), but there seems to be again a problem of valuation and promotion. A major question is: how specific must be ESS recognition? For example, the High Nature Value Agriculture HNV initiative (Paracchini et al. 2008) might be an alternative to ESS because of strong landscape orientation. Again this seems specific to areas which still have a lot of nature but it is more complicate for mundane agriculture. Any recognition for payments needs participatory approaches (Jones and Stenseke, 2011) along with landscape appearances and functions. Policy debates on CAP, ESS and needs “to have LSA value orientation” and that is limited so far (see interesting examples given by Santos et al. 2013).

5 ESS as Criterion for Shaping Landscapes

So far the discussion has been on a broad level, primarily to establish links among ESS, FSA, and landscape valuation, as well as policy. Now we will dig deeper into shaping of ESS and discuss how to accomplish a “right set of actions” and look at problems for valuation of action. Our hypothesis is: there are ESS aspects to be discussed at landscape scale and solved such as:

(1) The issue of providing ESS at landscape has to reckon adaptations of ESS as local and valuable concept for farmers, and check conditions of provision imbedded in landscapes.

(2) For an improved understanding of the link between farm productivity and ESS, ESS must be understood and accomplished as a soft science concept for the providers (farmers).

(3) The capacity to manage ESS plays a major role for provision. Are there tools which make ESS visible to farmers in managing them directly and indirectly through collective action or mutual recognition of activities; and are ESS provisions technically feasible in a sense of integrating them into farming practice and farming system approaches as analysis?

(4) What are the alternatives (with opportunity costs) in comparison to modern technology options, farmers prefer? Otherwise one cannot advocate farmers to recognise ESS,

before we get a link between LSA and ESS.

(1) Local Adaption

As a farming system is specific and locally adapted to accommodate ES-Functions and ESS, ESS provision must most appropriately reflect locality. In modern farming with a tendency to overuse resources (Nuppenau, 2002), industrial packages tend to equalize natural differences of landscapes. This makes it difficult for valuation of ESS. Though in general ESSs are substituted input consideration become generic rather site specific. A similar logic applies to bio-economics. For example, nitrogen recycling and nitrogen fixing by bacteria may be important, offer scope for bio-economics, but losses for not adapting can be only ignored in fertile regions. Less fertile areas show usually bigger needs for ESS and strong dependency on recycling. A good mixture of organic matter for rotting and nitrogen and soil moisture helps to support functioning of micro-organisms especially in sandy regions. Do we have values for that? Frequently, regulatory and supportive ESSs require special soil management practices at large (landscape) scale. Other examples are small forest islands, hedges, etc., (and theirs species) to gain habitats which offer potentials for organisms to develop ESS being reliant. An addition of more EMS especially in poor soils, is that they provide birdlife and birds feed on insects, vice versa, etc. (Feefe et al. 2002).

(2) ESS provision is soft science

Here we see links to a knowledge-based approach on FSA and LSA. Values can be gained either from experience and traditions or experiments. An example is even “fertility” as broad concept of acknowledging ESS. However, it can be observed (Swinton et al, 2007) that soil fertility contains ecological and farmers knowledge. It is naive thinking that it is only science-based knowledge. Traditional (soft) knowledge has been available for a long time, especially on soil formation (Ue-kötter, 2010). Notice fertility is not the same as outline of parameters in science for soil quality.

Fertility is traditional and value based, for example, farmers in Africa who are facing higher prices for external inputs see fertility coming from combinations of soil dispositions and biota. They may even rely on termites (Barrios, 2007) living in mounds that are part of a landscape for nutrient re-cycling; but do not recognize the ESF-ESS link; rather trees on mounds are considered sacred. In other cases management can still be active as soft science based on spiritual things (values of fertility); yet it is more than delivery of organic material under conditions of shortages in eco-systems. “Fertility” (instance of meadows as “poor or rich”) is broad. An example, perhaps in a biblical sense is natural and god given prosperity (see Merchant 2010, who showed for New England, USA, how values were recognizing Indian style of fertility and then land was destroyed).

(3) Capacity to manage

Limited capacities to manage the natural environment for ESS provision at community level because of existing right structures are a great hindrance in the adoption of ESS at landscape level. The problem is: ESS and underlying ESF are mostly not directly accessible and perceivable by farmers in the same way. Farmers are field and not landscape oriented and dependent on their holding. Traditionally manorial estates were more landscape oriented than modern farmers; whereas the current commercial famers mostly are field oriented, estate owners had a clue of landscapes. A typical example is modern fenced livestock rearing with domestic animals as opposed to semi-natural grazing and hunting. Control of boundaries is confronted with overlapping and competition of natural food webs (Zhang et al, 2007). So what is the obstacle? Limited trust! This can reduce cooperation in management of nature, ESS; but not necessarily. For example, farmers care differently for livestock (animal health) and ESS (pasture quality); but there is still appreciation of commons. I.e. if they have participated in joint formation of concepts and valued alternative it may work better (Hiedanpää and Bromley, 2018). The capacity to care about ESS (natural land) is limited under pure, strict private rights. A term which was coined in this context is that of a “reliability strategy” HRS (Richert, 1994), though it applies only to animals. Another frequently mentioned example is riparian river management and selective use of arable land in fragmented lands. In both case spots are farmed while natural landscapes remain intact.

(4) Cost comparisons, only

This aspect is the trickiest one, since it works with opportunity cost. ESS are usual virtual (not present); in a modern landscape we see the regime of opportunity costs strongly at work. For example, in the case of prophylactic spraying ESS are not considered because they are not branded or a promise work directly). Actually, the concept of opportunity cost has created many problems in ESS provision, mainly with scale as trigger. To dig even deeper, for example, in the case of intensification for energy crops (maize), the right to do it and the corresponding calculation of opportunity costs is solely at farm level. Farms aim at increasing size to meet biomass demand. A recent attempt to quantify the costs of interdicting conversion of grassland into cropping areas for maize and production of biogas (Landwirtschaftskammer Niedersachsen, 2012) has shown neglect of ESS and aiming at external input driven farming for biomass, only. Decision making of farmers is based mainly on opportunity costs for conversion (of crops as source for biogas which are less productive) merely locking at gross margins. The discussion on opportunity costs for ESS and decision making conserve vs. substitute ESS, has to be supplemented with an inquiry in right structures and costs-benefits analyses prevailing in decision processes. Who is an owner of ESS vs. right to maize or does a maize farmer contribute to ESS?

6 Public Managing of ESS in Landscapes as prerequisite of valuation

6.1 Public Management, Preferences, Visions and Joint Values

With the last remark on decision making as dependent on rights and obligations in favour of (or against) ESS cognition, we enter into a new sphere of analysis for land use systems and valuation. Firstly, we must acknowledge that decisions on landscape management and hence on ESS are embedded in common property management (Ostrom, 1990). This concept has gained popularity in the last decades in natural resource economics and management and is based on participation. One has to note there are several policy options and instruments (Rabotygagov and Feng, 2009) and it has to be clarified which policy option and institution best fit to ESS provision; in particular in addressing joint action for ESS coordinating units in nature and human spheres.

However, policies, institutions and their building as well as policy instruments must not be exogenous, rather it has been frequently suggested that internal forces can be created which promote endogenous formation of institutions. A process of formation, especially as offering participation, can work with things like trust building, mutual recognition of values, creating cooperation, and allows assignment of obligations to care for ESS, again with a focus on landscape elements. Farmer perceptions on the process matter strongly (Jongeneel et al. 2009). This includes obligations for provision and reciprocity as mutually agreed and it says: values, rights and duties matter.

Values of ESS, benefit sharing, etc. may be a cause of concern in communities with regards to analytical tools and management for ESS in landscape. In programming of landscape decisions, for example, it is important to include both decisions, at individual and community level, or as even as collective (Dabbert et al. 1999). In contrast to recognising private rights vs. collective rights as a component of collective decision making provision simulation from models should not be only individual. Decisions about the outlay of a landscape can become iterative and farmers' participation in ESS is contingent on achievements. The next question is how to organise collective decision? In social science studies, for example on land use system analysis (LSA) and valuation of alternatives collectively in group meetings, algorithms of participative decisions are there (Strassert and Prato, 2002). They are based on user rights and one has to find mechanisms on weighing priorities. Institutions can support collective decisions. Individuals will participate if they have separate rights on use but issues of provision of ESS to benefit for all matter.

We suggest starting with preference formation along rights and think that preferences can be modulated by institutions and crystallizing tools. Landscape ecologists have certainly made many contributions and attempts on clarifying perceptions of ecologically oriented, well-managed landscapes (their preference), but do they have common grounding concepts? For instance what landscapes should we look for in practice ("Leitbilder" in German)? And what are the interventions or regulations needed (and agreed upon) which are likely to create “natural” preferences at community level (social preference)? Integration of these aspects in decision making at landsca-

pe level is still weak. A problem is that visions and scenarios matter and they are initially diffuse and normative; hence they are already part of a prerequisite as well as elements of valuation.
So to say a normative (value oriented) discussion is not starting from zero ground. There are already different functioning concepts for the development of visions, as “Leitbilder” (Söderbaum, 2007) and scenarios as operational modes, also for decisions on group preferences. Proponents for certain ESS mostly create conflict with farmers; almost always preferences are still heterogeneous in practice and don’t follow “one” joint vision. So visions have to be discussed. Priorities and “Leitbilder” to a certain extent are considered subjective, reflecting interest, and not given objectively; they face the threat of being challenged on ground of particularity In other words, there are degrees of freedom within finding the right level of ESS landscape as visions. An example is the problem whether open landscapes are preferred for hunting, birds or woody landscape for small birds. “Leitbilder” are many times not clear and farmers become confused for assigning values. One way is to develop a process of decision making even on visions “Leitbilder” in LSA, which aim at differences in ESS inclusion; so it becomes a process in a community (Kumar, 2010). Instead of always talking about costs and benefits, ESS should be part of an “owned vision”. To integrate ESSs in visions and decision making imply long-term priorities of community living in a landscape which supports the well-being and it must be recognizable. ESS must be made visible. This can be done in terms of perceiving ESS as natural capital (Kareiva, 2011).

6.2 Joint Valuation of ESS

A management concept for a landscape should include a separate but joint valuation module for ESS and perceived natural capital associated with ESSs at landscape level. LSA should be designed to reveal scenarios of different natural capital use and accumulation or loss. It is here that even more visible aspects of ESS come into consideration: (i) what are relevant ESS indicators and how do valuation techniques (Kumar and Wood, 2010) guarantee capital maintenance? (ii) Can ESS simply be agreed with users? (iii) To what extent are they based on monetary valuation or broader? Etc. What is broader? Standards? Perhaps there are criteria which can invoke standards and do these standards matter more than capital (Randell, 2011)? And (iv) does nature respond, if so, at what time scale, to what extent, and what are the uncertainties? The questions (I to IV) must be discussed more intensely; because they require detail; we give only remarks:
(i) For example, Kumar (2010) focused on “pressures” on eco-system functions ESF (low capital values) and proposed that services ESS can become only an operational indicator to be valuated if we address them at management level by reduced pressure on nature (ESS). Pressure (change) is a normative concept and it mostly conceptualised as negative land use change. Typical examples are overexploitation, habitat degradation, disruption of food webs in ecology, etc.; i.e. loss of natural capital and valuation occurs along pressures. So pressures should be understood in joint valuation. Working with “pressure” apparently means working with those who use, initiate

and put the pressure on ESS (mostly farmers) at the same time as doing valuation. To integrate pressure indicators in costs and loss of natural capital (which is tricky with users who produce pressure) we can address landscape management options specifically. In the language of economists the pressure should be minimized and the capital declining aspect should be made clear in accounting. For example, the discussion on eco-nets as natural capital and a corresponding nature matrix and loss of net elements (Vandermeer and Wright, 2009 and above) would nicely fit into a new paradigm of joint group valuation. But is it per see and who owns the capital? Since research allows quantification of pressure an outlay in landscape (LSA) would be helpful.

(ii) The second question is even more complicated. Here, as usual, agreements with users on ESS, mostly farmers, are based on compensation for provision and looking at income level maintenance. In this regard, ESS quantification and valuation offer chances to receive money from outside (beneficiaries: for amenities, tourism, etc.); but increased transparency of exploitation is a problem. Many farmers may refuse to set aside land for ESS because they think that it is interferences in rights and eventually they will be cheated and lose their own future as farmers. Only receiving compensation imbedded in trust for long term commitment make them participating. A solution would be to introduce dynamic aspects and trust building in convincing farmers. This can be done at group level. Then farmers may become open to conservation. ESS is based on community valuation and payments as hybrids (incl. some coercion). Otherwise, seeing dangers of land price decreases due to conservation efforts by authorities and retreat is a negative vehicle.

(iii) As a third difficulty for nature valuation aiming at natural capital conservation, we see ESS creating biased perception on values. The crucial issue in this regard is that, though, valuation itself comes from users who are supposed to redirect behaviour towards ESS, values may change behaviour. Conservation perspectives have a danger to fail because they eventually create interest oriented to new users (ecologists). To obtain scientific analyses and farmers' valuation jointly with ecologists is difficult. We need real participation. We have to pinpoint hidden values. This, for example, is especially important for regulatory services in ESS because they come as conservation values instead of use values (mostly told by scientists). Regulatory services and their values are normally not in immediate recognition of users, but are underlying ESS (conservation). Maybe, (iv) valuation for regulatory services of ESS (see TEEB, 2010) should include least visible services. They contribute to a map of values and knowledge representation (values) in a landscape as whole beyond farming. The decisive thing is: can these values impact on decisions to conserve ESS or do they include other aspects? Let us put it this way as questions:

- (iv.a) Is there a real scope for less intensive farming (Beckmann et al. 2019) favouring regulatory services associated with bio-diversity for ESS to get rid of chemicals (can we have so-called extensive farming) and make nature self-regulating? Many things like the introduction of eco-nets and high nature value farming, eco-friendly landscapes, etc. (UK-NEA, 2011) are necessary ingredients of extensive farming at landscape level and have to be discussed in depth as community decision giving regulatory services priority and see scope for income with farmers.

- (iv.b) Is there already value recognition in daily operation for regulatory ESS? Value recognition in daily operation means that farmers, for instance, make assessments on combination of input purchases and ESS on the basis of maintaining the system vs. short run solutions (pest control). Can capital aspects of nature (based on regulatory services) be transferred into decisions on ESS prevalence (conservation) at micro-level? The question is: is there recognition of ESS to the extent that ESS are considered similar to inputs as production factors, etc.; and are they not simply substituted by inputs? A task of FSA as landscape analysis (LSA) is to show the importance of, for example, wetlands as production factor in cases of water scarcity, buffering droughts, etc.

(iv.c) Since it can be expected that farmers make only efforts to invest in ESS based on regulatory services, if regulatory services pay off, what is the value of land and eco-nets reliant on these services, if the price shows the pay-off? Yes, nature as landscape-wide capital can be established, if the recognition becomes deeper and farmers get a clou that land values increase with eco-nets. I.e. again if the returns are made clear, values emerge (though slowly). Good proxies (examples) for intact landscape are maintenance of hedges, offering habitats for birds, preying on insects, offering nitrogen retention by soil organisms, etc., i.e. all in a neighbourhood supporting ESS.

Finally in regards to finding improved valuation techniques (for farming with nature: ESS) and, in particular, getting a corresponding identification of ESS as production factor, as well as creating values of the service at landscape level (appreciable by land users, i.e. farmers and other users at landscape level), the responding issue of nature is of high importance. To put it in vernacular words: If nature does not fulfil promises frustrations can be the result. Farming with eco-nets (sometimes called Eco-farming and referred here to as Agricultural Matrix: Vandermeer and Wright, 2009) depends to a large extent on reliability of ESS provision. This is not always the case (especially in the beginning) since we see mostly degraded landscapes and ESS have to be restored in order to fully develop their character as production factor. ESS valuation is confronted with the question of how to obtain values from an uncertain delivery in case of degradation. The problem is, if a farmer compares the use of a bag of nitrogen or bowl of insecticide, today, with that of ESS in future, the bag and bowls give immediate and visible results; In contrast, ESS have to mature and will eventually have no short term impacts, but in years to come. (One has to wait till organisms show synergies to landscape planning with eco-nets). How to put that into value? Hence we have to work with discounted uncertain returns which are moreover still invisible today. This creates tensions and conflicts. The LSA view on habitats might not be understood by farmers yet; so valuation is a process of recognition. For example: Birds which depend on farmers' crops for food (as being pests for them) as well as homes for other species which control pest (being predatory) are difficult to appreciate and tolerate. In principle and practice, tolerating nature reduces pressure on habitats, but it seems not to pay off immediately in straight monetary terms. Especially risk and uncertainties prevail and they have to be translated into assessments of feasibility, patience and ambiguous values. Feasibility studies are needed. Otherwise ESSs are downgraded because the alternatives (farming with chemicals) are considered more "reliable".

7 Implications for Farming Systems as Landscape System Analyses

As discussed synthesizing farming system analysis FSA and applying the ESS concept as a landscape analysis for community valuation needs to address ESS at the user (farmer) as well as at landscape (design) level. On the one side this will help ecologists to think that minimal intervention (against pressure) will enable ESS fully to flourish only if it works in the wake of farmers' access to ESS thinking as "landscape". On the other side, the land users can do the best if they restrain from habitat modification. In the opinion of landscape ecologists, harvesting (using) ESS to a certain extent depends on doing nothing at all and restoration is the mere subject. Again, the problem is we are not dealing with wilderness as references (at least in Europe) but should try to imbed nature elements in cultural landscapes valuation. Then we have to look into management options for land allocation (creating a matrix), value them and get consensus.

Provision of ESS by itself is not a solution but making it available at minimum cost must be figured out (similar to Wossink et al. 1998). We have to accomplish joint eco-net designs. Such process may be determined by a novel job description of a reeve who is a custodian of ESS in a landscape and represents the joint valuation of larger areas. If money is involved the management task of compensation (in extended landscape management) is itself an additional activity and it goes beyond pure farm management. It includes determination of exchange rates (equivalence) for habitat and land, contribution (land or money) by ESS users compensating providers to facilitate negotiation (to minimize burdens of ESS), etc. This needs institutions.

A secondary vision for accepted institutions (at different stages) means that in principle everybody has obligation to contribute a piece of land, for instance "x" percent to eco-nets). That again is a value judgement given to the group. Then we need an accounting mechanism as an exchange on basis of quality (value) categories of land pieces. This ESS accounting of land should facilitate an "internal pricing" of land. In such cases land allocation in the eco-nets, according to ESF needs and ESS, requires new reward mechanism agreed on by the community.

Finally, I would like to stress that the issue of equity with respect to ESS use, access and natural capital ownership (with respect to the question of who "owns" the ESS as natural capital, the ecosystem, the eco-net, ESS, natural capital, etc.) in LSA is important. If correct ESS numeration and accounting of ESS as natural capital and assets for LSA (as extended farming) shall prevail, who will do it? Is system analysis from an economic point of view capable of achieving new organisations? Ownership is a concept which is primarily applied to individuals and works on inclusive rights; but it has to be extended to landscapes. Within LSA oriented farming towards landscapes and ESS provision questions of achieving collective ownership is a challenging task.

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