Native Breeds as Providers of Ecosystem Services: The Stakeholders' Perspective

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ABSTRACT

The concept of ecosystem services (ES) has become a keyword in biodiversity conservation and policies but, until now, it has rarely been applied in the context of farm genetic resources. Intensification of agriculture with internationally marketed breeds has led to remarkable loss in animal genetic resources (AnGR). There is a need for sustainable and feasible policies to conserve and utilise the AnGR, which requires knowledge on how they are valued by different stakeholders. We apply the framework of ES as a communication tool to explore how different stakeholders perceive the AnGR, their values and benefits. The research is based on interviews of stakeholders active on different levels of conservation. Our results highlight the broad diversity of perceptions of the stakeholders interviewed. The AnGR are linked to all categories of ES and viewed much broader than could have been anticipated based on existing research literature. This can be seen as a strength concerning the ES policies since considering AnGR not only as a provisioning services gives an opportunity to bring them out of the 'margins' where they have still tended to belong. The research also confirmed the applicability of the ES framework as a communication tool for AnGR. We argue that the ES approach, which integrates both ecological and cultural aspects of conservation, can be seen as a great opportunity for conservation and sustainable use of AnGR, as AnGR are, on the one hand, results from the co-evolution of human and nature and, on the other hand, dependent on cultural values and practices.

KEYWORDS: ecosystem services, indigenous breeds, animal genetic resources, biodiversity conservation

1 Introduction

Native breeds are farm animals originating from, adapted to and utilised in a particular geographical region (FAO 2012). The breeds are of economic, scientific and cultural interest to humankind in terms of food and agricultural production for the present or the future (FAO 2007). Because of their genetic resources (AnGR), they constitute an important part of agro-biodiversity that consists of the variety and variability of animals, plants and micro-organisms that are used for food and agriculture (FAO 2016a). The continuous loss of AnGR is a global environmental challenge, and in particular, native breeds are in danger of becoming extinct. Hence, their conservation is essential to the maintenance of agro-biodiversity (FAO 2007).

Biodiversity and ecosystems are closely related concepts: biodiversity affects the amounts, speed and timing of the flows of energy and materials through ecosystems (UK National Ecosystem Assessment, UK-NEA 2016). It is widely agreed that the Ecosystem Services (ES) framework provides a new perspective for the conservation of biodiversity. ES are the benefits provided by ecosystems that contribute to making human life both possible and worth living (UK-NEA 2016). There are various ways to classify and categorise ES ranging from various products to ecosystem functions to aesthetic experiences and other cultural benefits (see e.g. Haines-Young and Potschin 2011; Fisher et al. 2009; Wallace 2007; Boyd & Banzhaf 2007; Kremen 2005; Millennium Ecosystem Assessment (MA) 2005). The ES expand the focus from single resources to the full array of contributions which ecosystems make to human well-being, and aim to better recognize the interconnectedness of ecosystems across the broad temporal and spatial scales over which ecosystems and humans interact (Daniel et al. 2012). The strength of the ES framework is in its potential to integrate the provisioning (market goods) and non-provisioning (non-market, public goods) ES at the same level of priority (Rodríguez-Ortega et al. 2014), while bringing in also some methodological challenges to determinate and value these services (Chan et al. 2012).

Agriculture deals with ecosystem services and is directly managed to meet human goals, primarily to produce food and fiber. Due to the dominance of economic approaches, agro-ecosystems have traditionally been considered as sources of provisioning services but recently other ES have also been recognised. Provisioning services and regulating services, as well as cultural services and biodiversity conservation, are often viewed as trade-offs with production (Hoffmann et al. 2014; Arovuori & Saastamoinen 2013; Power 2010; Swinton et al. 2007). So far, there is only very limited research examining the native breeds within the broad framework of the ES (Hajjar et

al. 2008; Tancoigne et al. 2014). Yet, some single ecosystem services of native breeds have already been recognised by research, in particular the food products, genetic resources or valuable habitats or landscapes that they provide or maintain (Hoffmann et al. 2014; Rodríguez-Ortega et al. 2014). In addition, native breeds have cultural, social and other values (see e.g. Soini et al. 2012a; Narloch et al. 2011; Gandini and Villa 2003) that could be potentially identified and explored through ES framework and in that way made them more visible in the policies.

In this paper we argue that ES framework is helpful for identifying the various benefits and values that native breeds provide for the environment and human well-being, and therefore the framework has a potential for policy communication and policy making. The objective of this paper is twofold: firstly, to explore the ES framework for recognising ecosystem services obtained from native breeds; secondly, to explore how Finnish stakeholders perceive benefits and values of native breeds within the ES framework. In this way, the ultimate aim is to find out the conditions for operationalising the ES framework as a communication tool in policies concerning native breeds. In this paper we concentrate on the communicative aspect of the ES framework.

2 ES as a potential framework for analysing the values of native breeds

2.1 ES as a concept of biodiversity conservation

The maintenance of live animals in their adaptive environment is important for the conservation of native breeds. The main reasons for favouring live or *in situ* conservation relate to the objectives of conservation: opportunities to meet future market demands, insurance against future changes in production circumstances, present socio-economic value, opportunities for research, cultural and historical reasons and ecological value (Oldenbroek 1999). In addition to these objectives, the development of the breeds can continue with live animals in their adaptive environments. Another type of conservation, cryogenic or *ex situ* conservation refers to storage of frozen material, such as sperm and embryos (Oldenbroek 1999; Henson 1992). Both forms of conservation are needed to safeguard the AnGR but only live conservation can provide other ecosystems services than the option for future breeding.

The different ES classification schemes are founded upon the specific context in which they are being used as well as on the definition used (Fisher & Turner 2008). According to the MA (2005), ecosystem services are classified in four categories: provisioning, cultural, regulating and supporting services. Provisioning services provide material out-

puts, such as animals and crops, seeds or embryos from ecosystems, and they are tangible commodities which can be traded, directly consumed or used in food processing. Cultural ecosystem services are non-material benefits responding to people's cultural and spiritual needs, such as aesthetic and recreational enjoyment. They are based on symbolic, cultural or intellectual significance which many societies place on e.g. culturally significant species (Tengberg et al. 2012). Regulating services are environmental processes or ecosystem functions, such as pest control and pollination. Finally, there are supporting services which are necessary for the production of all other ecosystem services and include photosynthesis, supply of manure and grazing to create or maintain specific habitats for wild plants and animals. Out of these categories, the measurement of cultural services has been considered particularly demanding (Chan et al. 2012; Simpson 2013; Satz et al. 2013).

There is criticism related to the ES approach in general, and to the classification introduced by the MA (2005) in particular. The criticism mainly concerns (see e.g. Schröter et al. 2014) an anthropocentric, instrumental and utilitarian view of ecosystems, which sacrifices biodiversity conservation objectives and focuses on economic valuation. The validity of supporting services of the MA category has been questioned as it amounts to mixing ends (i.e. services they provide) and means (i.e. ecological processes necessary) (Lamarque et al. 2011; Wallace 2007, 2008). Since the introduction of the MA, there have been attempts to improve the classification of ES. The Economics of Ecosystems and Biodiversity (TEEB) replaced the supporting services with a new category of habitat services, whereas the Common International Classification of Ecosystem Services (CICES) introduced a hierarchical classification of ES (Haines-Young & Potschin 2011). Furthermore, Wallace (2007) has argued that one should classify the ES in a way that enables comparisons and evaluations of the consequences of different strategies. That would make the ES a helpful instrument for environmental management. Wallace (2007) and Boyd & Banzhaf (2007) have also pointed out that the identification of ES is dependent on the context as well as on human activities and wants. Others suggest that ES could be classified according to their spatiality: whether they are global or dependent on proximity; what is the location of the ES and the location of people using the service (Haines-Young and Potschin 2011).

The methodological challenges have in particular to do with the incorporation of cultural ecosystem services (CES) into the assessment of ES. They are intangible and therefore difficult to characterise and to measure (Satz et al. 2013). Recent studies have questioned whether the ES concept even provides an appropriate framework for understanding the spatially and temporally changing processes, or the individual and collective valuations that are included in CES (Pröpper & Haupts 2014; Winthrop 2014). However,

while acknowledging this critique, we follow the authors who see that the ES approach is useful when connecting or reconnecting society to ecosystems. It provides a holistic framework to analyse the values across the disciplines and policy sectors. The CICES (2013) framework recognises provisioning, regulating and maintenance and cultural service themes. The supporting services are treated as part of the underlying structures, processes and functions that characterize ecosystems. The final ecosystem services are further divided into five categories: section, division, group, class and class type. The main difference between the TEEB and CICES classification is that the former treats habitat services as a distinct group, whereas in the latter they are identified as a part of regulation and maintenance services (CICES 2013). We use the CICES classification to identify ecosystem services obtained from native breeds, assuming that supporting services as defined by MA (2005) provide value to people only through other services (see Chan et al. 2012).

2.2 ES concept and native breeds

Agriculture is in the core of the discussion regarding both biodiversity and ecosystem services. Agricultural practices create and maintain special ecosystems and habitats but also enable the creation of new varieties and breeds. Hence, agriculture maintains biodiversity but agricultural production methods and management determine whether agriculture enhances or diminishes biological diversity (Soini 2007), in other words, whether it provides ecosystem services or disservices (Arovuori & Saastamoinen 2013). Following the CICES (2013), agriculture supplies provisioning, regulating and maintaining and cultural services but also demands them to be productive (Swinton et al. 2007).

The concept of ES has been used e.g. as a synonym for ecological services, landscape services and environmental services and to refer to input and output services for agriculture. The term ecosystem goods is sometimes used only for those services that have a direct market value, such as food (Lamarque et al. 2011). This derives from the assessment that the most important benefits gained from agro-ecosystems come from the provisioning services, and that all other ES are related to food production (see e.g. Arovuori & Saastamoinen 2013). Regardless of the focus on provisioning services, in most cases both tangible goods and immaterial services provided by ecosystems are recognised as ecosystem services (Lamarque et al. 2011).

The ES framework is widely used to bridge the gap between economics and ecology and therefore these two approaches primarily dominate the discussion (Chan et al. 2012). As yet, native breeds have not been widely discussed in the ES framework. There are analyses concerning the Payment for Ecosystem Services (PES) and other

valuation of non-market products and services provided by native breeds (see e. g. Zander et al. 2013; Hoffmann 2011; Narloch et al. 2011). The concordance between native breeds and ES are also referred to in some of the research concerning sustainable agro-biodiversity management and policies related to it (see e.g. Lescourret et al. 2015; Morgan-Davies et al. 2014; Bernués et al. 2011).

3 Data and methods

The data concerning Finnish stakeholders were collected by interviewing representatives of various organizations and actors engaged in the conservation of native breeds. The stakeholders represented agricultural and environmental administration, education, research and NGOs as well as private entrepreneurs who are engaged in native breeds on different levels of production. The stakeholders were selected to represent different levels and groups of those people and institutions which affect the conservation of native breeds either directly, such as the administration, or indirectly, such as the entrepreneurs who use the products and services provided by native breeds in their businesses.[1] The interviews with altogether nine stakeholders were conducted in the years 2011-2012. The interviews were thematic in character and addressed the following topics: the status of native breeds and the conservation criteria in Finland; governance instruments of the native breeds' conservation; the conservation of native breeds and their organisation; and sustainable use of native breeds and their organisation.

We analysed the interviews with the help of ES concept as a communication tool to explore whether the ES provides a feasible tool to unfold the benefits and values associated with native breeds. The ES concept was not presented to the stakeholders in advance. This decision was made to ensure that the answers reflect the stakeholders' real perceptions, as well as to avoid perceptions being biased towards assumed 'right' answers. The interviews were recorded and transcribed and then translated into English for this paper.

1 The interviewees comprised a representative of the Ministry of Environment, a member of the Finnish National Advisory Board for Genetic Resources; a representative of the Farm Advisory Centres; a representative of the Finnish Animal Breeding Association (FABA), a member of the Finnish National Advisory Board for Genetic Resources; a representative of the Central Union of Agricultural Producers and Forest Owners (Farmers' Union); two representatives of a vocational school for agriculture; a representative of a vocational school for agriculture and a foundation for promoting urban-rural interaction, a member of the Finnish Animal Breeding Association; a representative of the Finnish Landrace Association; and a representative of a cooperative producing meat and milk products of native breeds.

Table 1. Ecosystem Services provided by native breeds according to CICES classification

Section	Division	Group	Class	Class type	Further information
Provisioning	Nutrition	Farm animals for food	Food products	Meat, dairy products, eggs, honey	Tienhaara et al. (2013)
	Materials	Biotic materials	Non-food animal fiber	Wool, fur, skin, feather, down, bones, wax	Arovuori & Saastamoinen (2013)
		Fertilizer	Organic nitrogen fertilizers	Manure, urine	Hoffmann et al. (2014)
		Genetic resources	Genetic diversity; livestock breeds	Sperm, embryos, other genetic material	Oldenbroek (1999)
		Medicinal/biotechnical resources	Animals and organisms for biochemical industrial and pharmaceutical processes	Laboratory animals, test-organisms, biochemical products	Hoffmann et al. (2014)
	Energy	Biomass-based energy	Animal-based material	Manure, methane, ammonium	
		Mechanical energy	Animal-based energy	Draught power	
Regulation and Maintenance	Mediation of waste, toxics and other nuisances	Mediation by farm animals	Waste recycling and conversion of nonhuman edible feed	Recycling of crop residues, household waste, swill and primary vegetation consumption	
	Mediation of flows	Mass flows	Land degradation and erosion prevention	Maintenance of vegetation cover; moderation of extreme events (avalanche)	Morgan-Davies et al. (2014)
		Liquid flows	Regulation of water flows	Natural drainage and drought prevention, influence of vegetation on rainfall, timing and magnitude of runoff and flooding	
		Gaseous/air flows	Storm protection	Maintenance of vegetation cover; moderation of extreme events (fire control)	
			Ventilation and transpiration	Maintenance of vegetation cover (pastures, grazing lands)	
	Maintenance of physical, chemical and biological conditions	Lifecycle maintenance, habitat and gene pool protection	Pollination and seed dispersal	Bees pollinating, seed dispersal by animals, yield and seed quality in crops and natural vegetation	Hoffmann et al. (2014) identifies maintenance of life cycles of species and habitat connectivity (seed dispersal) as habitat services
			Maintaining habitats and gene pools	Pasturing, native breeds as live gene banks maintaining genetic diversity	Hoffmann et al. (2014) identifies maintenance of genetic diversity as habitat service
		Pest and disease control	Pest control	Farming practices, pasturing; destruction of habitats of pest	Oldenbroek (1999)

			Disease control	Genetic diversity between and within breeds; destruction of disease vectors	
		Soil formation and composition	Maintenance of soil structure and fertility	Nutrient cycling on farm and across landscapes, soil formation	Hoffmann et al. (2014) identifies maintenance of soil structure and fertility as supporting service
		Water conditions	Water quality regulation/purification	Water purification/filtering in soils	Hoffmann et al. (2014)
		Atmospheric composition and climate regulation	Climate regulation	Soil carbon sequestration, Greenhouse Gas (GHG) mitigation	
Cultural	Physical and intellectual interactions	Physical and experiential interactions	Charismatic or iconic habitats	Conservation of native breeds, native breeds as pets	Soini et al. (2012b)
			Recreational activities	Rural tourism; Rehabilitation services (Green Care), sports, shows	Soini & Lilja (2014)
		Intellectual and representative interactions	Scientific	Agricultural, sociological, economic etc. research: scientific discovery	Hoffmann et al. (2014)
			Educational	Knowledge systems and educational values; agricultural extension for farmers, environmental education; cognitive development	
			Heritage, cultural	Use in national and regional culture, gastronomy, stories, sense of place	Gandini & Villa (2003)
			Entertainment	Native breeds in media, arts and literature	Partanen (2005)
			Aesthetic	Appearance of the animals; landscapes; inspiration for arts, design and cultural activities	Hoffmann et al. (2014)
	Spiritual, symbolic and other interactions	Spiritual	Symbolic	Native breeds as national or regional symbols, e.g. Finnhorse in WW2	Leinonen (2013)
			Sacred and/or religious	Native breeds in myths concerning ancient religious ceremonies	Yarwood & Evans (2000)
		Other cultural outputs	Existence	Intrinsic value in their own right	Jarvis et al. (2007)
			Bequest	Part of history; gratefulness; intergenerational thinking	Leinonen (2013)

4 Results

4.1 Classification of ES provided by native breeds

In Table 1 we have provisionally divided ecosystem services provided by native breeds in different ES categories. The division is based on earlier research literature concerning the values of native breeds (e.g. Oldenbroek 1999) and ES provided by livestock (e.g. Hoffmann et al. 2014; Arovuori & Saastamoinen 2013). Therefore, it should be noted that many of the services are obtained from other breeds as well. The classification contains both direct and indirect services provided by native breeds.

Similar to other livestock, native breeds provide provisioning services that consist of e.g. food, fiber and energy. The regulating and maintaining services include e.g. disease control in terms of genetic diversity between and within breeds. The cultural services consist of the role of native breeds e.g. in leisure time activities, recognised environments and history. Compared to ES provided by other livestock, we assume that the provision of genetic resources is of special importance when analysing native breeds. Another ES that are likely to be highlighted are the cultural services, in particular cultural heritage. In addition to the impact on environmental challenges, such as erosion due to overgrazing, potential disservices are related to the lower yield of native breeds.

The ES categories are not mutually exclusive: they overlap and often provide simultaneously material and non-material benefits that are hard to separate (e.g. MA 2005; Chan et al. 2012; Satz et al. 2013). Therefore, it is essential to identify the connections between different services. For example, food accounts for provisioning services but simultaneously plays an important role in local gastronomy providing cultural services. The overlapping categories form a challenge to the classification of the ES but reflect the biological, geophysical, social and economic interactions of the real world (MA 2005). In that sense, the ES classifications can contribute to an understanding of how ecological structures and functions are associated with many cultural aspects of human well-being (Chan et al. 2012). Therefore, it is essential to explore the diversity of the services that the ecosystems provide instead of treating all ES as presenting the same services. The inclusion of cultural ecosystem services in environmental assessment is thus important (Satz et al. 2013).

The economic and ecological perspectives have dominated the ES research but have not been able to encompass all dimensions of ES benefits and values (Chan et al. 2012). To make the classification clearer, e.g. Chan et al. (2012) and Satz et al. (2013)

suggest that it is necessary to make the appropriate distinction between *services, benefits* and *values*: three terms that in the ES discussion are often confounded and used in different ways. Following Chan et al. (2012), services are the ecosystem processes underpinning benefits; benefits, as valued goods and experiences, comprise the level on which people can most easily relate to ecosystems; values are the preferences, principles and virtues that we hold as individuals or groups. In other words, service means the production of benefits, and many services produce many benefits, which are of value to people for many kinds of reasons. In this framework, a single service can generate one or more benefits, and each benefit can be associated with different values (Satz et al. 2013; Chan et al. 2012). The benefits are often bundled together, which makes the classification of services challenging. Furthermore, different values do not constitute entities according to which people make their choices. In reality, motivations for conservation are a complex mixture of different value-types (Chan et al. 2012).

4.2 Finnish stakeholders' views on native breeds as part of ES

The stakeholders recognised many of the services classified in Table 1. Some aspects of the provisional division were not discussed at all. This reflects the novelty of the ES classification in questions concerning the native breeds. More importantly, it shows how the stakeholders currently perceive the benefits and values of native breeds. In the following, we will explore the services, benefits and values related to native breeds as identified by the stakeholders. We will also analyze whose benefits and values are in question when discussing different services. The classification follows the typology of Chan et al. (2012) for the distinction between services, benefits and values. Since we use the CICES classification (2013), the supporting services do not form their own category of services.

4.2.1 ES obtained from native breeds

The interviewed stakeholders recognised all three categories of ecosystem services as defined by CICES (2013). They identified provisioning services as the production of material benefits, and regulation and maintenance services as an option for future breeding purposes. The most discussed aspect of native breeds was nevertheless their role in the production of cultural ecosystem services (CES). The emphasis on cultural services is probably a question of trade-offs. The yield of native breeds is lower than that of commercial breeds, and to compensate for this deficiency, it is natural to highlight their sig-

nificance in the production of CES. The stakeholders were active on different levels and sectors of the conservation of native breeds, and thus in favour of their preservation.

4.2.2 Benefits produced by services

The first aspect regarding the benefits of native breeds were the *material benefits* and goods which the breeds provide: milk, meat, wool and skin and other materials, such as semen and embryos for commercial use. The same preference concerns the promotion of local products, which in addition to material benefits had benefits both in terms of *employment* and of *place/heritage* and identity: special products from certain breeds that exist only in certain areas (see also Ovaska & Soini 2011). The following extract shows how the regional breeds could be used to promote local products and rural vitality:

> I would love to see [producers and products of native breeds] all over. They would surely have local markets. It would be nice to have it everywhere in Finland, not only in Helsinki but in the provinces. (Cooperative)

The genetic resources were seen as an important material benefit, because of the special traits they carry. In particular, the genetic resources of Finnsheep were seen as a potential product for export, thus emphasizing the importance of material benefits but above all the *option* for future breeding.

> Speaking of our native breeds, they are very interested in Finnsheep abroad; because it is so fertile, [...] fat free carcass, three different colours, fine wool. It raises interest in different countries, hence we could well export it. (Farm Advisory Centre)

At the time of the interviews, the most topical environmental questions concerning agriculture were those addressing climate change and water-based ecosystems. Consequently, some of the interviewees saw the issue of native breeds being on the background related to these challenges and implied that it is a marginal environmental concern:

> Water management and fighting against climate change are important, genetic resources have more to do with biodiversity, although there is a connection between them and climate protection and water protection. Genetic resources are important when considering climate change and also, I think, water ecology. Genetic resources are a sub-plot concerning landscape and biodiversity. (Farmers' Union)

The breeds maintain biodiversity *per se* in terms of genetic variety, which refers to the very benefit of their *existence*. The stakeholders acknowledged the importance of native breeds and recognised threats to their existence, for example those related to climate change. One interviewee called for "critical and even provoking debate on AnGR similar to GMO" (Ministry of Environment). Another interviewee highlighted the role of human beings in the maintenance of the ecosystem services, as "humans are part of the chain of the ecosystem services" (Farmers' Union). Speaking of agriculture, this is particularly true. However, the interviewee held that the role of the human is often neglected in the Finnish biodiversity policy, although the benefits of native breeds can only be obtained through human-nature interaction (see also Lyytimäki & Petersen 2014).

> Now we have the concept of 'maintenance', an understanding that valuable habitats need people. In Europe, they are aware of this in political decision-making, habitats cannot be maintained without people. Finland comes last, maybe because traditional agricultural environments are lost, if they become indicators, one can understand it. (Farmers' Union)

The visual factor of native breeds as cultural ecosystem services provides an *aesthetic benefit*. There is an aspect of beauty in the animals themselves; in the way they look and in the way they behave (Mace et al. 2012). Aesthetic preferences of ES are subjective (Rodríguez-Ortega et al. 2014). The interviewees reported their personal experiences on these aspects:

> Already in childhood, it attracted my attention how [Finncattle] made contact with people. As a child, I went to see the cows and, of course, the one which came to see me was somehow different. I remember it. And I love the colour. I love brown colour in general and the colour of Western Finncattle is really warm. They are beautiful cows. (Foundation)

The aesthetic benefits are connected to benefits regarding *employment*: rural vitality, businesses engaged in rural tourism or rehabilitation services, and their customers. The therapeutic and educational use of the animals in prisons and school farms were mentioned to be positive for both the residents or students and the breeds, but also for the society as *activities* that the cultural services obtained from native breeds produce.

Many of the interviewees mentioned the *heritage benefit* of native breeds. It is not only about what one's ancestors have made in the past but also about a continuous process of interpreting, valuing and managing the heritage in the contemporary

society by different actors (see also Tengberg et al. 2012). The native Finnish breeds were originally regional breeds, but are now spread across the country. The 'regionality' and 'nationality' of the breeds raised some arguments among the interviewees. As one of the interviewees noticed, Eastern Finncattle is originally a regional breed of eastern Finland "which is first and foremost Eastern: from Karelia, Savolax" (Association). Despite this view, Finnish native breeds are widely regarded as 'national' cultural heritage.

Cultural identity in the context of ES implies the current linkage between humans and their environment. It is an overlapping concept with the heritage benefit to some extent but refers more to the individual's sense of self as related to social and interpersonal links and roles (Tengberg et al. 2012). This was understood by the stakeholders who referred to identity in defining the branch and its actors. "For some sheep farmers, it is a great part of their identity as sheep farmers to rear a native breed, too" (Farm Advisory Center).

Cultural identity was discussed at different levels (northern periphery, national and regional) and it was linked with the traits of the breed arising from the local environment. "Diversity and culture are connected with local adaptiveness which has developed in 1000, 2000, maybe 3000 years. [...] Nevertheless, there can be something: they are special and their meat has a certain taste" (Association).

In addition, *spiritual benefits* related to breeds were mentioned. These benefits were explained as arising from the 'naturalness' of the breeds. Another aspect was that the native breeds could be best conserved as spiritual benefits: "This kind of spirituality could be paralleled with religious enthusiasm supporting the conservation of the breeds" (Association).

Cultural ecosystem services provide a wide range of *inspiration* for art, architecture and folklore (MA 2005). The Finnish artist Miina Äkkijyrkkä is well known of her work related to local breeds (Kissa 2007). The breeds may also be used in cultural events, presenting the way of life in the 17th century, as one of the interviewees described (School). In our interviews, the breeds were seen also as a source of inspiration for an alternative way of life, in particular for youngsters with an urban background. Although there were some doubts related to this kind of a romantic way of life, it was considered an option for some people. It was also noted that this heritage should be passed on to younger generations and to those still to come. In other words, the breeds provide *knowledge* benefits.

4.2.3 Values underlying the services

The *anthropocentric value* of native breeds was emphasised in the interviews, which is natural given that native breeds are components of agriculture, and thus dependent on human-nature interaction. Other values underlying the perceptions and evaluations concerning native breeds varied between different stakeholders. Many interviewees working on the implementation level concentrated on the material benefits provided by native breeds. For these stakeholders, the *values mediated through market* were emphasised. It was a preference to show that native breeds have commercial potential. These stakeholders concentrated on the commercial potential of Finncattle and Finnsheep which are in a hegemonic position among the Finnish landraces compared with other species due to their economic importance.

Regulating and maintaining services often remained as abstract background information to the services and benefits which the interviewees wanted to highlight. Most commonly, regulating and maintaining services, environmental processes and ecosystem functions were mentioned in order to show the interviewed stakeholder's awareness of the issue:

> Of course biodiversity and such are important. That is partly the reason for being here and trying this. The background is there. But speaking of realism: no one pays my bills, if this does not work. (Cooperative)

Some stakeholders saw greater significance in the conservation of native breeds and put more emphasis on the future options provided by native breeds. The representative of an agricultural school pointed out that from the *anthropocentric* point of view, native breeds have *instrumental* value for the uncertain future:

> Working in the agricultural field, we have to admit that we need to take care of them. You never know what happens in this world. Maybe we need the genes one day. If they cease to exist, there is no way to get them back. (School)

Due to the regulative function of native breeds for ecosystems, all the breeds tend to have the same *supporting or instrumental* value. This was pointed out by the representative of the Farm Advisory Centers who highlighted that there is not enough knowledge to state which species/breeds are more important than others.

> [One cannot put genetic resources in order of importance.] Not in my opinion, because we cannot know. Thinking about the changing universe, the globe, climate change and all. I am not wise enough to say what the most beneficial one is in the future, or important to us, the most important. (Farm Advisory Center)

Both *self-oriented* (existence value) and *other-oriented* (bequest value) values are essential in understanding the importance of biodiversity maintenance. It includes intergenerational thinking, which means that native breeds are not kept only for our needs but for the needs of the future generations as well. The gratitude was not only addressed to the landraces but also to the farmers who had kept them, it was again a question of *other-oriented* valuation, although neither the past nor the future generations can express their own perceptions of the *existence / bequest benefit* (see Chan et al. 2012):

> At least I am aware of the value that [the breeds] have lived here with us and developed with people here in the North, they have historical value. We have a responsibility to maintain our ancestors' work and preferences. They brought them here from somewhere long ago and raised the cattle. They were a lifeline to them, we should also uphold them. (Foundation)

According to the interviewees, it is the responsibility of the Finnish people to conserve breeds which are locally adapted, as no one else will. It was not only the breeds, but also the associated local food culture which was considered to be threatened by multinational food industries and various regulations. During the rapid modernisation process of agriculture in the post-war years, the official view towards the low-yielding native breeds was to replace them with other breeds. Nowadays, the role and status of native breeds have been reconsidered, and they receive higher appreciation and have *inherent or final* value. However, this value is not easy to measure:

> The monetary value is quite small at the moment when considering the sales of native breeds. The value in terms of cultural history is much more. Only a few per cent of our cows are native; it is obvious that the amount of milk is not significant. (FABA)

5 Discussion

In this paper, we have explored the ES framework for recognising the ES of native breeds. The framework shows that the ES provided by native breeds are similar to other livestock, but assumably their emphasis is on genetic resources and CES. Hence, we have analysed how the Finnish stakeholders perceive native breeds in the ES framework. We have interviewed stakeholders to find out whether they recognise different ecosystem services, as defined by the CICES (2013), and how they identify the ES as benefits or values, in order to better understand the potential of the ES framework in agro-environmental policy making. Literature has revealed a lot of potential for using ES in policy making concerning native breeds as a communication tool: it helps to represent services, benefits and values obtained from ecological processes in words that are understandable in multidisciplinary scientific and political discourses. Simultaneously, to avoid misrepresentations, there is a need for precise definitions of what ecosystem services are. This is also essential for effective implementation and use of the concept (Lamarque et al. 2011). A clear understanding of the definition and characteristics of ES as well as transparent and appropriate classifications should enable science to inform, rebut, and debate society's understanding of the issue. Conversely it should provide research with information about what is important for the public and decision makers (Fisher et al. 2009).

5.1 How do the stakeholders recognise the native breeds as providers of ES?

The provisioning services are emphasised by both literature and interviews. The provisioning ES consist of tangible products, and are easily regarded as the main ES that native breeds provide. Thus, the ES related to agro-biodiversity have significant use values (Narloch et al. 2011), and the provisioning services constitute the most important way of using native breeds. According to Hoffmann (2011) the reason for emphasising the provisioning services is obvious. They take over the other ecosystem services as governments and businesses usually put the highest emphasis on the economic dimensions of sustainability in their development decisions. The provisioning services provided by native breeds are therefore the most explored in research literature, and the first ES mentioned by stakeholders as displayed in our interviews.

Therefore, it is interesting that the stakeholders extensively highlighted the CES in the interviews (see also Hauck et al. 2013). Overall, CES were discussed by the interviewees more than any other category of ES. The CES are often valued over other ES

in developed societies and their need is estimated to grow in the future, especially in the form of recreation and other leisure time activities (Milcu et al. 2013). The belief in positive impacts on human well-being obtained by native breeds can be recognised in the background. The stakeholders identified CES relating to cultural identity and heritage, CES that e.g. Milcu et al. (2013) refer to as essential for traditional communities. The aesthetic appreciation of live animals and landscapes based on childhood experiences and the needs of citizens of modern societies contribute to the CES recognised by stakeholders.

The role of native breeds as a regulating and maintenance service was brought up, in particular, regarding biodiversity. The relationship between ES and biodiversity is complex, as biodiversity can be seen as a synonym for ES or as an ecosystem service itself (Mace et al. 2012). Also in the research literature the maintenance of biodiversity has been seen as an important aspect of ES provided by native breeds (see e.g. Morgan-Davies et al. 2014). It is clearly a question of benefits gained from native breeds in terms of maintenance of genetic diversity and option for future breeding. However, the regulating and maintaining services stayed in the background in the interviews.

5.2 How do the stakeholders see benefits and values?

In the context of CES, the stakeholders were at their strongest when showing the values they hold concerning native breeds. This is not surprising as in some ES classifications CES are defined as values (Chan et al. 2012). All stakeholders identified the cultural and historical benefits of native breeds, but differed in their opinions of how these should influence the current policies concerning native breeds: whether the native breeds should be utilised in new forms of rural entrepreneurship or conserved as a non-market mediated relic from the past; whether the cultural and historical benefits were background to be respected or the main reason for conservation.

Temporal and spatial aspects were brought up several times by the stakeholders. Intergenerational thinking, gratefulness towards the history of the breeds and the work and life of previous generations, and educational benefits to younger generations were considered important. The spatial aspects comprised both local and global dimensions. Native breeds are important in local culture and history but the genetic resources provided by them are of global importance. However, in the interviews only provisional and cultural benefits were placed in time and space. Therefore, taking care of biodiversity as a regulation and maintenance service was seen as a responsibility of the government whereas the sustainable use of live animals, and the provisioning

and cultural services and benefits obtained from them, was regarded as a business or other opportunity at the implementation level. The ES are dependent on the context in which they are produced, and therefore the role of implementation level is essential in understanding the real processes of obtaining benefits from ES (Hauck et al. 2013).

Appropriate agricultural management practices are critical to realising the benefits of ecosystem services and reducing disservices from agricultural activities (Power 2010). Trade-offs occur when the provision of one ES is reduced as a consequence of increased use of another ES (Rodriguez 2006). There are trade-offs between provisioning services on the one hand, and regulating, supporting and most cultural services on the other (Hoffmann et al. 2014). Because of the lower yield of native breeds, the stakeholders emphasised the role of native breeds as providers of cultural benefits. In the context of agriculture, provisioning services are usually regarded as the most important provider of benefits. However, in the case of native breeds, the stakeholders felt it important to underline other benefits in addition to speaking of specialty products and other forms of rural entrepreneurship favouring the use of native breeds.

6 Conclusions

The ES concept provides a framework to identify the values of native breeds by recognising not only provisioning but also other ecosystem services connected with culture, identity and nature (Rodríguez-Ortega et al. 2014). According to our research, in addition to the provisioning services, the CES were identified by the stakeholders in different ways. Hauck et al. (2013) have received similar results in their research concerning ES policies perceived by stakeholders. This strengthens the perception of ES as a feasible approach in the case of farm animals which are cultural animals and whose maintenance is dependent on human activities. There are also challenges regarding the definition of the ES concept, which should be developed further, and regarding the several classifications of the ES framework, which should not be mutually exclusive and thus oversimplify the ES at the higher level (Fisher et al. 2009; Hauck et al. 2013). Lyytimäki and Petersen (2014) suggest that ES concept should be seen as a set of different heuristics to identify and evaluate the role of ecosystems in human societies. In this sense, the ES can be used as communication tool for policies instead of a mere monetary valuation of benefits obtained from nature.

Regarding the conservation of native breeds, there are particular challenges that can be overcome with the help of ES concept. The marginality of native breeds' conservation compared with other environmental issues was clearly shown in the inter-

views. We argue that the recognition of native breeds as providers of ES helps to make them more visible in the politics and promotes their sustainable use and conservation. The decision-making processes themselves do not rely purely on scientific information. Therefore, the stakeholder interviews revealed what issues and perspectives are regarded important in the short term, and what information is actually utilised by decision makers (see also Fisher et al. 2009).

Hoffmann (2011) has noted that the extinction of AnGR continues at an accelerating rate unless better ways to maximise co-benefits between biodiversity conservation and economic development are found. The native breeds bring lower private market returns to farmers but generate non-marketed ecological and cultural public good benefits (Midler et al. 2015), and therefore it is essential that the values of native breeds are recognised among relevant stakeholders, farmers and the wider public. According to Lescourret et al. (2015) the sustainability of agro-ecosystems depends on their ability to deliver an entire package of multiple ecosystem services, rather than provisioning services alone. The same applies to native breeds and their conservation, and new social and ecological dimensions of agriculture need to be explored to foster this ability (see Lescourret et al. 2015). In our research, the stakeholders recognise native breeds as providers of ES, even to a wider extent than the research literature at the time of the interviews did.

We argue that the ES approach, which integrates both ecological and cultural aspects of conservation, can be seen as a great opportunity for conservation and sustainable use of native breeds, as they are, on the one hand, results of the co-evolution of human and nature and, on the other hand, dependent on cultural values and practices. Although it is nowadays widely understood that biodiversity has intrinsic value and should be conserved for its own sake (see Jarvis et al. 2007), the ES and human well-being are likely to become more important arguments for the need to preserve the natural capital, as Haines-Young and Potschin (2009) have argued. More research is thus needed on the linkages between different categories and the trade-offs.

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