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Trees, soils, and warthogs – Distribution of services and disservices from reforestation areas in southern Ethiopia[☆]



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ABSTRACT

Conservation projects have often been criticised for creating global benefits while causing negative impacts on local livelihoods. Ecosystem services approaches have been seen as one way to change this by focussing explicitly on maintaining ecosystems for human well-being of stakeholders at various scales. However, ecosystem services approaches have often ignored trade-offs between groups of people and issues of power and do not automatically lead to better outcomes in terms of human well-being. Here we report on a study on the impacts of reforestation projects with an explicit focus on human well-being in three communities in southern Ethiopia. We investigated the distribution of services and disservices from reforestation using qualitative methods. Results showed that the services and disservices from reforestation were distributed unequally across space and wealth groups resulting in widespread dissatisfaction with existing reforestation projects despite the explicit focus on human benefits. To improve outcomes of reforestation it is necessary to acknowledge and manage disservices adaptively, include issues of power and make trade-offs transparent.

1. Introduction

During the last few decades the concept of ecosystem services has risen to prominence not just within academia but also as a new approach to environmental conservation, restoration, and development. The rise of ecosystem services approaches can in part be seen as an attempt to reconcile conservation goals and human well-being. Traditional conservation approaches such as reforestation in enclosures have often been criticised for imposing substantial costs on local people and their livelihoods while the benefits such as biodiversity conservation and climate change mitigation mostly are of a global nature (Adams et al., 2004). As a consequence, often such initiatives attract very little local support (e.g. Bennett and Dearden, 2014; Maikhuri et al., 2001; Shrestha and Alavalapati, 2006). Even though later conservation projects have increasingly sought to incorporate benefits for local people (e.g. through sharing of revenues from wildlife tourism) or to compensate them for losses, the main impetus was still that of conservation for its own sake, that is, conservation based on the notion that nature should be preserved for its intrinsic value independent of its

usefulness to humans. With ecosystem services approaches came a shift in the arguments from conservation for its own sake to conservation for the sake of all the goods and services that nature provides to humans (Mace, 2014), that is, conservation of nature based on utilitarian arguments. In contrast to pure conservation approaches, ecosystem services approaches explicitly focus on the links between ecosystems and human well-being. We here define well-being as a multi-dimensional concept encompassing not only material wealth, but also aspects such as autonomy and freedom to act, physical and mental health, relations with others and security (Agarwala et al., 2014). Focusing on ecosystem services may therefore seem like a promising approach in terms of avoiding conservation at the cost of local people, and development at the cost of the environment. Inherent in ecosystem services approaches is an underlying assumption that explicit acknowledgement and focus on nature's goods and services to humans and the externalities associated with many economic activities (e.g. in the form of unaccounted for pollution) will automatically result in conservation of the environment (Turnhout et al., 2013). Many of the frameworks and models developed since the Millennium Ecosystem Assessment (2005) reflect

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on the link between ecosystem services and well-being (Fisher et al., 2014; Sikor et al., 2013) and provide the rationale for interventions aiming at both environmental conservation/restoration and human well-being. However, a focus on ecosystem services to humans does not automatically lead to better outcomes in terms of biodiversity and (different) people's well-being (Dawson and Martin, 2015; Turnhout et al., 2013) and often the focus remains on higher scales, such as in landscape-scale restoration.

Despite the emphasis on 'what nature does for people' many questions remain regarding the implications of using ecosystem services frameworks as a tool for nature conservation. Critical voices have pointed out that ecosystem services approaches tend to promote a shift towards a reconceptualization of nature in terms of its market value and often reinforce existing power relationships (Berbés-Blázquez et al., 2016; Gómez-Baggethun and Pérez, 2011; Turnhout et al., 2013). Other 'blind spots' which are often ignored include ecological as well as social complexity within as well as between scales, the co-produced nature of ecosystem services, and the existence not only of services but also of disservices (Berbés-Blázquez et al., 2016; Lyytimäki and Sipilä, 2009; Norgaard, 2010; Rasmussen et al., 2016; Reyers et al., 2013). Following Lyytimäki (2015) we here define disservices as "functions or properties of ecosystems that cause effects that are perceived as harmful, unpleasant or unwanted". Examples include pathogens of humans, livestock and crops, and 'pest' species which eat or damage crops. In addition, ecosystem services approaches often focus on one particular service or benefit which can have negative impacts on other services (Kull et al., 2015). Like earlier approaches to conservation, ecosystem services approaches mostly ignore the awkward issue of trade-offs between services and disservices and how these are distributed amongst different groups of people (Bennett et al., 2015; Daw et al., 2011; Howe et al., 2014; Lele, 2013; Suich et al., 2015). Instead, emphasis is on politically palatable win-win situations, despite the fact that such situations have been shown to be the exception rather than the rule (McShane et al., 2011). However, ignoring existing trade-offs not only amongst different ecosystem services but also amongst groups of people may seriously undermine ecosystem services approaches, especially where ecosystem services approaches are coupled with development/poverty alleviation goals. Distribution of services and disservices is ultimately a question of power though this is often mediated through factors, such as gender, ethnicity, age, geographical location, etc. As analyses of ecosystem services based approaches to conservation and restoration projects often look at the aggregated level of services and benefits, power issues and distribution of services and disservices remain invisible (Daw et al., 2011). A disaggregated 'accounting' of both services and disservices and their distribution across people and space can therefore help to understand the outcomes of ecosystem services based approaches for both conservation and the livelihoods of people living in or around these areas. Likewise, explicitly including power as part of the analysis may help to provide a richer and more informative picture of ecosystem services and trade-offs (Berbés-Blázquez et al., 2016). Analyses of power and environmental justice not only need to look at issues of distribution and resource access but also at recognition and participation (Schlosberg, 2004; Sikor, 2013).

Here we look at the example of forest regeneration projects in southern Ethiopia which have been initiated with the explicit aim of benefitting local people, and ask whether such a focus on ecosystem services provision does in fact guarantee better outcomes in terms of livelihoods and human well-being. In the study region, forest regeneration in enclosed restoration areas is seen as an important way of combatting soil erosion and degradation while at the same time providing additional services in the form of timber and non-timber products to the local residents. Forest regeneration areas have been established since the 1980s, with the newest ones dating from the 2010s. These are long-term enclosed communal areas administered by local forest committees under local government's supervision. We use this example to look at the ways in which services and disservices are



Fig. 1. The case study areas are situated in the Halaba district (circle) in the Southern Nations, Nationalities and People's Provincial state of Ethiopia (the area marked in red) (source: TUBS, Wikicommons). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

distributed and mediated in the context of reforestation projects with an explicit focus on benefits to local populations. As our starting point we take local perceptions of the services and disservices and how these are distributed amongst people using a grounded analysis based on focus group discussions and participatory methods. In addition, we investigated how decisions are made and implemented and how this relates to people's experiences of the services and disservices from the restoration areas. By doing so, this study also aims to inform current large-scale restoration efforts in the context of poverty alleviation and sustainable development.

2. Study area

The study took place in three communities (Laygnaw Arsho, Assore and Andegna Choroko) in Halaba district ('woreda' in Amharic), in Ethiopia's Southern Nations, Nationalities and People's Regional State (see Fig. 1). The majority of the population in this area are small scale farmers with on average less than 2 ha of land per household (unpublished survey data collected for the ESPA ALTER project). Most of the agricultural production is for subsistence (mainly Maize) with surplus being sold at the market as well as some cash crops such as pepper, coffee, and khat. Ethnically, there are two major groups in the area, the Halaba (accounting for about 50% of the population) and the Silte, accounting for about a third, while the rest of the population belong to a number of other groups. The large majority of the population is Muslim (around 94%) with the rest being Orthodox and Protestant Christians. Based on our fieldwork and research in the area, ethnicity is not a major factor influencing or mediating access to resources and livelihood means.

Soil degradation and erosion are recognised as serious problems in the area and deep erosion gullies are a common sight. According to farmers, erosion and soil degradation have been caused by deforestation linked to increases in the human population and a shift from livestock to mainly crop based livelihoods from around the 1970s onwards (see Section 4.1, below). One initiative to reverse soil degradation and erosion has been the reforestation of degraded, communal areas. Reforestation and afforestation policies were favoured by the government during the socialist military council – 'Derg' regime (1974–1987) – to both tackle biomass shortages due to the increasing rural population and the oil price crisis in the 70s and counteract the negative environmental effects of deforestation that resulted from the agricultural modernization

programme championed during the Imperial period (Ayana et al., 2013; Jagger and Pender, 2000). This policy focused on collective and state-owned plantations that focused primarily on wood products from fast growing exotic species (Ayana et al., 2013; Jagger and Pender, 2000). The drought and famine in the 80s triggered a shift from a primary focus on production to the production of multiple benefits (Ayana et al., 2013). Large-scale efforts at restoring degraded areas were very much implemented in a top-down fashion under food-for-work programmes (Nedessa et al., 2005). In addition to government-led initiatives, development agencies such as The World Bank, United Nations World Food Programme and international NGOs, provided funds to support these reforestation projects (Jagger and Pender, 2000). Current ‘greening’ programmes, such as the Humbo Assisted Natural Regeneration Project¹ developed by World Vision and the World Bank, have been established as a means to address climate change and alleviate poverty (Brown et al., 2011). While current reforestation projects have principles of participation embedded in them, the interpretation of what this means varies widely amongst projects (Nedessa et al., 2005).

In the three study sites, the reforested areas were of different ages and sizes, with the oldest ones dating back to the 1980s and the youngest ones less than five years old, and ranging from around 60 ha to around 270 ha in size (see Table 1). The three communities were selected to include restoration areas of a range of ages, sizes and tree species for the study of services, disservices and trade-offs. These restoration areas were established on what has been heavily degraded communal grazing land. Livestock grazing is always excluded from the restoration areas. While limited tree cutting and collection of dead wood is allowed, the reforested areas are maintained as forest and not cleared again. In all three communities, the reforestation had been initiated by outsiders (government and/or NGOs). The techniques and species employed have changed over time from when the first restoration areas were established in the early 80s using mainly exotic species to more focus on native species in more recent restoration efforts. In all three communities, the reforested areas were governed by locally elected community committees, though according to advice from the district government agency (see Section 4.4, below). Community members implemented management decisions in compulsory, annual work campaigns (watershed programmes) and through voluntary food for work programmes (safety net programmes) targeting the poorest households. In all three areas, local guards (paid with money generated from the reforestation areas) were responsible for ensuring that rules were followed, and breaking of rules was sanctioned, mostly through fines.

3. Methods

In order to elicit local perspectives on the restoration areas, in May 2014 we conducted two focus group discussions per site followed by participatory mapping and participatory photography exercises in January 2015 (see Table 2 and additional information below). Participants across different wealth categories and gender were selected by local facilitators. To do this, first, a list of households in the community was elaborated jointly with the community leader and key informants. Then, households were categorised into three different wealth categories (i.e. poor, medium, and rich) using a participatory wealth ranking exercise. Wealth categories were defined by the participants in terms of material and non-material assets. Material assets included for example livestock, cash crops and good quality housing while examples of non-material assets are knowledge, health and empowerment of women. This list and categorisation of households was used for the selection of participants in order to ensure a representation of diverse views and capabilities.

One of the focus groups explicitly addressed the services, disservices, and governance of the restoration areas. This included

Table 1
Main characteristics of the restoration areas.
Source: ALTER (2014).

Restoration area	Size (ha)	Age (years)	Main species composition	Population
Assore	112	33	<i>Eucalyptus spp.</i> , <i>Acacia seyal</i> , <i>Grevillea robusta</i>	2479
Andegna Choroko	65	6–33	<i>Eucalyptus spp.</i> , <i>Acacia saligna</i> , <i>Acacia albida</i> , <i>Grevillea robusta</i> , <i>Croton macrostachyus</i>	3115
Laygnaw Arsho	270	3–33	<i>Eucalyptus spp.</i> , <i>Acacia albida</i> , <i>Acacia seyal</i>	4500

Table 2
Summary of methods and participants per study site.

	Assore	Andegna Choroko	Laygnaw Arsho
Focus group: restoration areas	7 (3 women, 4 men)	5 (2 women, 3 men)	8 (4 women, 4 men)
Focus group: livelihoods	16 (8 women, 8 men)	12 (6 women, 6 men)	12 (6 women, 6 men)
Participatory mapping	3 women 8 men	5 women 5 men	8 women 5 men
Participatory photography	3 women 4 men	4 women 4 men	14 women 5 men

questions on how access to different services was regulated and who benefited or suffered from disservices. In the focus group we did not use the language of ecosystem services (and disservices) but asked about the good things and the bad things about the reforestation areas and how they were distributed across the population and spatially.

In the other focus group discussions centred on people's livelihoods and changes that had taken place in the area, in order to understand the wider context around the establishment of the restoration areas. The focus groups had between 5 and 16 participants with about equal numbers of men and women, aimed to bring together a diverse group of local villagers to try to capture different gender and wealth perspectives. The discussions lasted 1–2 h and were conducted in the local language (Halaba) with a local community member acting as translator between Halaba and the national language, Amharic. However, as most of the male participants were able to speak Amharic as well, discussions would sometimes slide over into Amharic thereby excluding non-Amharic speakers (typically women). In addition, cultural norms meant that even Amharic speaking women contributed less frequently to the discussions than men in mixed groups. In the subsequent exercises (participatory mapping and photography) we therefore had separate groups for women and men.

In addition to the focus groups, in January 2015 we conducted two participatory exercises per site. The first exercise consisted of a participatory mapping of services and disservices from the local area (again phrased as good and bad things). The second exercise was a participatory photography exercise (also known as photovoice) where we went for a walk with small groups of participants during which they took pictures of the things from the environment they regarded as good or bad. These images were then uploaded on a computer and shown to the groups who had taken the pictures and used to discuss what the pictures showed, and why they thought these things were important.

Discussions were audio recorded and translated from Amharic into English by Ethiopian co-authors. Notes from all exercises were subsequently uploaded into qualitative data analysis software Nvivo where they were coded for services, disservices, and distributional issues. Within each of these categories, more specific codes were created by repeatedly going over the material and identifying recurring issues and topics.

¹ <https://wbcarbonfinance.org/Router.cfm?Page=Projport&ProjID=9625>

4. Results

4.1. Changes in livelihoods and environment

In all three focus groups on wider changes in the area and people's livelihoods all the participants agreed that there had been a trend of deforestation from the Imperial period prior to the military Derg regime (i.e. before 1974) to the present. As causes for this trend, they identified an increase in the human population combined with a shift from livestock centred livelihoods to crop cultivation focussed farming. The latter was linked to the political changes when the military Derg regime came to power. Under the Imperial regime in the preceding period land ownership in the region had generally taken a feudal structure where local people were generally tenants living on the land of large scale landlords. Under this system, half of any crops cultivated on the land had to be handed over to the landlord. According to the participants, this meant that people were generally disinclined to cultivate crops, but focussed on livestock rearing instead. During this time, people used to graze their animals freely in the forest areas. In one focus group participants also mentioned that during this time they used to derive fruits and bushmeat from the forest. With the advent of the military regime came a redistribution of land under the slogan 'land to the tiller', which handed over land to tenant farmers (though without the right to sell the land). At the same time, the military regime promoted crop cultivation in the region, and the population in the area started to grow. Taken together, these developments meant that people shifted towards more crop cultivation and forest areas were gradually decimated to bring more land under cultivation as well as to provide construction materials and fire wood. In all three areas, participants said that the deforestation and more intensive crop cultivation gradually led to a decrease in soil fertility and to problems such as soil erosion. In one focus group, participants also linked deforestation to climatic change, saying that it had made the area drier and caused crop failures. In addition to the decline in forest cover, participants in all three areas stated that there had been a change in forest composition away from native species to introduced species such as Eucalyptus and Grevillea.

4.2. Local perceptions on services and disservices from reforestation

In all three communities, villagers recognised that the reforestation areas provided a number of services (see Table 3). In terms of ecosystem services these included provisioning as well as regulating, supporting and cultural services. The most important provisioning services were timber for construction and fuel, and grasses for livestock fodder and thatch. Sale of these products (and of quotas for their collection) constituted an income source both at the level of the communities and for

Table 3
Ecosystem services from restoration areas identified in the three communities.

	Ecosystem services	Assore	Andegna Choroko	Laygnaw Arsho
Provisioning	Timber	x	x	x
	Grass	x	x	x
	Honey	x	x	
	Seedlings		x	
	Water storage	x		x
Regulating	Flood reduction	x		x
	Erosion reduction		x	
	Soil conservation	x	x	
	Cooler climate	x		
Supporting	Improved upland areas	x		
	Green space	x		
Cultural	Tree shade	x		
	Visits & support	x		
	Knowledge generation	x		

individual households. At the community level, timber and income from sale of forest product quotas had been used to construct and run community facilities such as schools and health centres. For households, having access to these products from the restoration areas was seen as something which saved households money. Even though people had to pay a fee to be allowed to collect a certain amount of product, this was cheaper than buying the products from the market. This also meant that those who did not use the products themselves could resell them at a profit in the market and thereby supplement their income. In some reforestation areas beehives had been established, and the forest was therefore also seen as a source of bees (for those wishing to establish their own beehives) and honey. Amongst the recognised regulating and supporting services were cooler temperatures, and reduced flooding, erosion and gully formation. Some of the focus groups distinguished between erosion reduction and soil conservation. Although these overlap, soil conservation refers to broader practices aimed at conserving and enhancing soil structure and fertility.

Cultural services associated with restoration areas were also recognised, particularly in Assore where people went to a dam constructed in connection with the restoration area to fetch water and let their livestock drink. In addition to the water itself, people mentioned the shade provided by big trees while waiting with their animals and the opportunity this shade gave to discuss social issues and gather with people from the community. In some cases, trees were also used to mark the end of Ramadan and to celebrate religious ceremonies. Similar issues were mentioned in all the other villages, but in relation to trees in other public and private spaces such as the school and front yards of the houses. In Assore, restoration areas were also seen as attracting visitors and support from different organisations and as a way of generating knowledge.

In all three communities, villagers saw a link between deforestation and problems such as erosion and flooding. Although perceptions about the causes of deforestation were shared across villages (see section 4.1, above), perceptions of the services of reforestation with regard to reduced flooding and erosion differed within and amongst communities. While some participants thought that the reforestation areas had substantially reduced erosion, others saw them as less efficient and only applying to a very small area. Some, but not all, participants also felt that having participated in the communal reforestation and restoration projects had provided them with knowledge which they could make use of on their own plots.

The main disservice from reforestation, which was brought up in all three communities, was the damage inflicted on crops by wild animals which had moved back into the areas as forests had been regenerated. Hunting is not allowed under current wildlife legislation in Ethiopia and therefore the only way farmers could prevent crop attacks was by patrolling and guarding plots especially during the night. Disservices were particularly large for those households whose plots were adjacent to the restoration areas. These households could lose most of their harvest in a single animal attack. The species perceived as most problematic was warthog, but porcupines and various kinds of monkeys were also mentioned as causing substantial damage to farmers' crops. In addition, hyenas were said to occasionally attack livestock. Malaria and water-borne diseases were also mentioned as one of the disservices from the development of small ponds and other rainwater harvesting systems in the restoration areas. Thus, while water storage was mentioned as a service from these areas, it also comes associated with some disservices. However, disservices associated to standing waters were seen less problematic than wildlife attacks.

As the reforested areas had previously been communal grazing areas, we had anticipated that loss of access to grazing would be seen as a major negative outcome from restoration. However, this was mentioned only once, presumably because the areas selected for reforestation were heavily degraded areas and had hence already lost most of their grazing value prior to the establishment of the reforestation projects. In addition, although services outnumber disservices from

restoration areas, the discussions showed that many of the participants thought that the services did not outweigh the damage done by animals. Participants indicated that, although restoration areas contribute to livelihoods, subsistence strategies depend mostly on the cultivation of individual plots which are used for private consumption and, in case of surplus, for selling at the local markets. This was also linked to the limited amounts of materials, especially timber, which could be (legally) extracted from the reforestation areas (see section 4.4). It also meant that disservices such as crop raiding affect the main source of income for households, especially those with plots located in areas nearby the restoration area.

4.3. Local perceptions' on the factors that influence the creation of ecosystem services and disservices

Participants in the three communities mentioned a range of factors influencing delivery of ecosystem services from the reforestation areas. The most important factors related to the composition and age of the restoration areas. The selection of species for replanting was based on recommendations from government agencies and had changed over time as different species and approaches were favoured at different times. In some of the earlier restoration areas, mainly exotic species such as eucalyptus had been planted while more recently established areas typically consisted of a mix of native species and part of one area was left to regenerate naturally. Different species provided different services and disservices. Eucalyptus, for example, was valued for its quick growth and its timber, but was seen to use a lot of water and to deter other plants from growing in the vicinity. Native species gave less timber, but resulted in areas that were good at providing fodder and thatch. While some thought that naturally regenerated reforestation areas and those consisting of native species harboured more wild animals (and hence resulted in more crop damage) than areas which had been replanted with species such as eucalyptus, others thought that there was no difference in the amounts of wild animals and crop damage linked to different reforestation areas. Some participants expressed the wish for more useful species in the form of timber or fruit trees to be planted in the reforestation areas.

In addition to species composition, the age of the restoration areas also influenced what services they delivered and how people benefited from these areas. Participants acknowledged that while some products were obtained after a couple of years, tree products only appeared after more than a decade of enclosure. Younger restoration areas were seen as providing a lot of fodder and thatch. As restoration areas matured and the tree canopy closed in the provision of fodder and thatch grasses typically declined. In contrast, older reforestation areas contained more timber than younger ones but yearly services, such as grass and thatch, were lower. While timber had higher market value, quotas for its extraction were very limited, and mostly timber was only used for the construction of communal facilities and in emergency situations. Hence, grasses which had a lower monetary value, but which could be extracted in higher amounts played a more important role in the livelihoods of most households.

4.4. Factors which influence the distribution of services and disservices

In all three communities, the distribution of services from the restoration areas was governed by forest committees consisting of elected community members. Communities elected representatives for the committees, who usually served for a term of 3 to 4 years, though in one of the communities (Andegna Choroko) focus group participants indicated that committee members would stay longer if there were no complaints. The committees were composed of between 7 and 10 members. At the time of the field work the committee in Andegna Choroko was composed of 5 men and 5 women, in Assore of 4 men and 2 women and in Laygnaw Arsho of 7 men. While these committees set annual quotas and prices for grasses for thatch and fodder from the

reforestation areas, in two of the areas this was done in consultation with government agencies. Prices tended to be set at below market prices, but to follow general market trends. For two of the areas there were also quota for timber, though these would not be provided annually but rather at longer intervals and prices and quota were determined by the government agency. Timber was also cut for communal purposes (e.g. building a school) or given free of charge as construction material to poor households in emergency cases where their houses had been damaged and needed rebuilding. There were large differences amongst the communities and reforestation areas with some committees assigning timber quotas at regular intervals and others never depending on the species composition and age of their reforested areas. For example, in older reforestation areas which mainly consisted of eucalyptus, timber extraction was more frequently allowed compared to younger areas and those consisting of native species. Hence the services available to the community members differed.

In all three communities, bylaws regulating the access to products were determined by the elected committees and followed the principle of equal rights to everyone. This meant that all households had the same right to buy a fixed amount of the available products at the price determined by the respective community forest committee. This was meant to ensure that wealthier households did not benefit more than poorer ones. However, according to the participants, these rules were frequently circumvented by informal agreements between richer households (who were keen to obtain more than their allotted quota) and poorer households (who did not have sufficient funds to buy the products they were entitled to). In these cases, poorer households would get the money from the richer households and buy the products on their behalf against a small commissioning fee. In addition, some participants also indicated that there were examples of richer households obtaining larger quota or better quality materials directly from the forest committees in direct circumvention of the rules. Participants also reported that richer households were more likely to steal products, such as timber, as they could afford the fines imposed in case they were caught. Poorer households on the other hand were said to be too frightened by the threat of fines, too large for them to pay, to attempt violating the rules. While richer households thus were in a position to take more advantage of services (either semi-legally or illegally) from the reforestation areas, they were at the same time less dependent on these services. Typically, richer households had more land than poorer households and were therefore more likely to allocate some of their own land to tree planting which provided them with their own, private supply of timber, fuel wood, and leaves for compost making, in addition to grazing land. The results also point to some gender differences regarding the services generated from restoration areas, which may reflect gendered roles, responsibilities and resources. For example, timber was mostly mentioned in the focus groups conducted with men, while others, such as grass, were recognised both by men and women. More valuable products are usually considered the responsibility and property of men, while women are responsible for harvest and sale of lower value products. Differences in fodder distribution can be explained, at least in one community (Andegna Choroko), by the fact that two women's cooperatives had been allocated special rights in relation to the reforested areas, such as being able to collect more fodder grass for livestock owned by the cooperatives.

In all communities, improvements in soil fertility and erosion and flood control were two of the environmental reasons for the initial establishment of reforestation areas. Not surprisingly, the participants generally acknowledged that soil fertility had improved in the reforested areas. However, this did not provide any direct services to the farmers as the areas outside of the reforestation areas generally continued to be degraded. Hence, farmers only benefitted indirectly through the other services that depended on the soil inside the reforested areas such as the growth of grasses for fodder and thatch. Some participants were hoping that in time they would be allowed to once again cut down the forest and turn these areas back into agricultural

fields which would then benefit from the restored soil fertility. However, the oldest areas were more than 30 years old and there was no sign that these would be allowed to be converted to agricultural land again. In terms of reduced erosion and flooding, these services were more clearly felt and appreciated by at least some of the participants though others complained that the reforested areas had not been effective in stopping erosion and flooding in the surrounding areas. Even where the reforested areas were seen to have reduced erosion and flooding, this was mainly in the areas downhill from the restoration areas. Some participants also thought that their own agricultural fields had benefitted indirectly, as participation in the reforestation work had meant they had acquired new knowledge of different options that they could use to restore fertility on their own land.

The distribution of services from the reforested areas was thus influenced by a variety of factors, including household wealth in interaction with the existing governance of the reforested areas, and topography and location. In contrast, the distribution of disservices in the form of crop damage from wild animals was dependent only on the location of farmers' fields in relation to the reforested areas. Those who had their fields close to the reforested areas thus suffered more damage than those whose fields were located further away. According to the participants there were no discernible patterns in relation to where the fields of richer or poorer people were located.

4.5. Existing strategies for dealing with disservices

At the time of the fieldwork, no compensation mechanisms were in place to recompense farmers for the losses suffered from wild animal attacks. However, richer households often had several plots and generally more land, and were less vulnerable to the loss of part of their crops. Households whose fields were close to the reforestation areas typically tried to minimise the risk of crop damage by having a person stay out in the field during night time to guard the crops. However, this was seen to have negative impacts on people's health (due to lack of sleep) and the availability of labour for other tasks. Some people had also tried to build fences, but these were generally not sufficient to keep the animals away. Some participants also mentioned switching crops in response to animal attacks. However, this was a problematic response in that the crops most prone to wildlife damage (e.g. maize, sorghum, and teff) were also amongst the most important subsistence crops. Maize was especially important due to its multiple functions with different parts of the plant being used for different purposes. Switching to less vulnerable crops was thus more feasible for richer farmers who had several fields and who typically grew a greater variety of crops (cash crops as well as subsistence crops). They could therefore grow vulnerable crops such as maize where there was less danger of animal attacks and grow other crops where attacks were more likely (depending on the location of their fields). Participants also reported that some people had simply stopped growing crops as a result of the damage inflicted by wild animals. However, this should not be seen as a coping mechanism but rather as one of the most severe manifestations of the disservices from the reforestation areas. In case farmers became destitute as a result of the loss of their crops, they did become eligible for general government 'food for work' aid programmes.

As hunting is not allowed under current wildlife legislation in Ethiopia, some participants mentioned that they had tried to block the exits of the warthogs' burrows in order to get rid of them. Ultimately, according to participants, the only effective way of dealing with the problem of crop-raiding would be to reduce the number of animals through hunting. Participants suggested that this could be done either by allowing the villagers to hunt the animals or by getting a government agency to regulate the number of the animals. Participants did not discuss any strategies for dealing with disservices linked to standing waters (malaria, water-borne diseases).

5. Discussion

Many studies of ecosystem services mainly focus on inventories of different types of services while ignoring aspects of justice and power, including aspects of distribution, recognition and participation. In this study of reforestation projects in southern Ethiopia, we found that services outnumber disservices. Based on a simple aggregate inventory of ecosystem services it would therefore seem that these reforestation projects have been very successful and this is indeed the way these kinds of projects have often been portrayed (Nedessa et al., 2005). This is similar to the way in which costs and benefits are evaluated in larger scale initiatives such as landscape-scale conservation and restoration projects meant to tackle both environmental degradation and poverty alleviation (e.g., Menz et al., 2013). Nevertheless, in the three study sites there was widespread dissatisfaction with the reforestation amongst the local participants. Our study thus shows that employing an ecosystem services lens does not in itself guarantee that restoration projects will overcome the shortfalls of previous restoration and conservation approaches. Such approaches may therefore suffer from similar pitfalls as earlier conservation approaches lacking local support. From the discussions with villagers it was clear that several factors contributed to their divergent views of the reforestation areas. These were related to a perceived imbalance between services and disservices, issues of distribution and issues of participation.

Firstly, while the participants acknowledged services such as cooler temperatures, reduced erosion and flooding risk downhill from restoration areas, and goods in the form of wood and grass these did not have the same immediate impacts on their livelihoods as the disservices from wildlife. Partly this was due to the nature of these services and issues of scale.

The scales at which management interventions take place and are planned, are typically of a higher order (e.g. regional, national and longer term), compared to the scales at which local people derive benefits from ecosystem services (Kull et al., 2015). The benefits of soil restoration are thus long-term, partly very localised (e.g. improved soil fertility within the reforested areas) and partly at the landscape scale (e.g. reduced siltation of rivers) or even at higher scales such as in the case of carbon sequestration. For the individual farmers, improvements in soil fertility would only be realised if they were allowed to convert the forest back to agricultural land. However, this did not seem to be part of the planned management for the reforested areas. Hence the 'side-benefits' from the reforested areas in the form of construction materials, fire wood, fodder and thatch constituted the main services for the participants and were highly important in relation to the support or lack thereof for reforestation. The perceived imbalance also related to the experienced disservices in the form of wildlife attacks on crops with potentially devastating consequences for their livelihoods. The negative impacts from wildlife attacks cannot be measured solely in terms of the magnitude of crops lost, but also need to take into account the uncertainty and anxiety caused by the largely unpredictable nature of wildlife attacks, and the need to spend the nights out in the fields attempting to protect the crops resulting in adverse health impacts (Khumalo and Yung, 2015). Taken together, this had resulted in villagers' experience that the reforestation mainly seemed to be for wildlife and not for humans. Our study thus indicates that employing ecosystem services frameworks is not in itself enough to ensure that conservation will contribute to an increase of human well-being. While our study is based on the example of specific reforestation projects in one part of Ethiopia, we suspect that similar imbalances can be found in other conservation and restoration projects focusing on supporting and regulating ecosystem services. For ecosystem services based approaches to be successful in the long term more needs to be done to get the balance right between longer term supporting and regulating services and locally important services and disservices. This includes taking serious local experiences and values (Turner et al., 2008) and if necessary finding compromises between services which are important over the

long term and often at higher scales and in the form of public goods, and more immediate, locally important services for individual households. This could for example be done by including more timber species or maintaining a thinner tree cover to promote the production of fodder and thatch grass.

Secondly, the distribution of services and disservices was unequal both within and amongst different areas. While rules aimed at ensuring a degree of equality in the distribution were in place, we nevertheless found that wealthier households were in a better position to appropriate services legally or illegally. At the same time wealthier households were less dependent on these services and less vulnerable to the disservices. This is similar to findings from other studies and highlights the relationship between livelihoods and services as well as vulnerabilities and power relationships (e.g. [Berbés-Blázquez et al., 2016](#); [Dawson and Martin, 2015](#); [Dickman, 2010](#)). Local power dynamics and access to resources therefore need to be taken into account both in relation to the study of ecosystem services and in projects seeking to promote environmental restoration using an ecosystem services framework. This includes asking who benefits in what ways and at what scales and who loses out, making trade-offs visible and explicitly including them in the management and decision making. However, trade-offs and how they play out may not be predictable beforehand, due to the complex and dynamic nature of social-ecological systems. Dealing with trade-offs therefore entails monitoring how the system and the balance between services and disservices and their distribution develops over time, and in response employing flexible rules and adaptive management approaches, which can be adjusted in response ([Armitage et al., 2009](#); [Chazdon and Uriarte, 2016](#)).

This leads us to the third point which concerns participation and governance. Although local participation is embedded as a guiding principle in reforestation projects in Ethiopia, the meaning of ‘participation’ is interpreted in varying ways and may in reality not mean much more than participation in implementation ([Nedessa et al., 2005](#)). Local participation can be seen as an end in itself, which may help to foster greater feelings of ownership and acceptability of environmental management such as reforestation initiatives ([Reed, 2008](#)). Many ecosystem services based approaches mainly focus on the outcomes in terms of services themselves while ignoring issues of governance and participation ([Spangenberg et al., 2015](#)). This is especially important in countries like Ethiopia where the early history of reforestation projects was marked by top-down approaches, which has generated a legacy of distrust and uncertainty ([Nedessa et al., 2005](#)). In addition, greater local participation in management decisions could potentially help to modify the balance between services and disservices (e.g. by modifying the species and age composition and managing wildlife). In addition, services and disservices are intimately linked to values as well as livelihoods, and to understand trade-offs between them therefore also requires the inclusion of local knowledges and values in the decision making process ([Galafassi et al., 2017](#)). However, greater local participation is not a panacea that can solve all problems. Villagers were already involved in designing distributional rules, and while these were following principles of equality, they were at the same time de facto favouring richer households. Often multiple interpretations co-exist regarding what ‘just’ means in the context of reforestation or conservation projects ([Martin et al., 2014](#)). Local perceptions of what is just need to be taken into account for reforestation projects to succeed ([He and Sikor, 2015](#)). This includes making different interpretations and their consequences explicit, including trade-offs between different groups of people or different sets of values ([Daw et al., 2015](#); [McShane et al., 2011](#)).

6. Conclusion

While the reforestation areas have been successful in relation to the stated goals in that they have managed to improve soil fertility and reduce erosion and flooding, the reality of the experienced trade-offs on

the ground meant that there was widespread disappointment and dissatisfaction with the reforestation projects in the three communities. This happened despite the explicit focus on reforestation as a means to improve human well-being. The mismatch between the professed aims of reforestation, local expectations, and the realised services and disservices and their distribution contributed to undermining local support to reforestation as the reforestation areas were by some seen to mainly benefit wildlife rather than humans.

In order to design ecosystem services approaches that can truly contribute to human well-being and poverty eradication, it is necessary to dis-aggregate services and disservices, to acknowledge trade-offs between different services and disservices and different groups of people, and find the mechanisms to tackle them ([Daw et al., 2011](#); [Dawson and Martin, 2015](#); [Lele, 2013](#)). Ecosystem services management entails decisions that are inherently political as decisions about, for example, which services to focus on, and how and what to measure, all have consequences for who benefits and who loses out ([Kull et al., 2015](#)). Therefore, power relations also need to be taken into account when trying to design reforestation and other environmental management approaches that are meant to contribute to the improvement of people’s livelihoods and well-being. However, far too often ecosystem services approaches have ignored them. In line with [Howe et al. \(2014\)](#), a focus on trade-offs, rather than on win-wins, provide a stronger basis for the design of interventions that are more likely to achieve those win-win outcomes. To do so requires meaningful participation of local people in evaluating outcomes, designing and adjusting management rules and negotiating the distribution of services and disservices. This is important not only in relation to restoration efforts aimed at the local scale, but also in relation to larger scale initiatives such as landscape-scale conservation and restoration projects which are increasingly gaining support to tackle global problems, but which risk failing by ignoring trade-offs at the local scale and between the local and higher scales.

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