

**Perception of communities on managing exclosures as common pool resources in
northwestern Ethiopia**

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Perceived benefits and drawbacks of exclosures

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Abstract

Understanding the different perceptions of the local community regarding the use and management of common pool resources such as exclosures, could better support targeted interventions by government and development partners. Here we report a study conducted in the Gomit watershed, northwestern Ethiopia, using a survey and key informant interviews to examine community perceptions on a) the biophysical condition (i.e. challenge of land degradation and restoration), (b) the action situations (user's access to and control over resources and decision-making processes towards taking actions in managing the exclosure), (c) actors' interactions (formal and informal institutions involved in the management of exclosures), and (d) perceived outcomes (benefits and tradeoffs of managing exclosures). Many people in the watershed recognize land degradation as a serious problem and believe that exclosures support restoration of degraded landscapes and improve ecosystem services. Informal institutions play a key role in managing exclosures by improving benefit sharing and mobilizing the local community for collective action. However, some community members have concerns about recent expansion of exclosures because of (a) limited short-term derived benefits, (b) reductions in fuelwood availability, (c) increased degradation of remaining communal grazing lands, and (d) poor participation of marginalized groups in decision making. Addressing such concerns through the promotion of short-term benefits of exclosures and increasing community participation in decision-making and benefit sharing is crucial. The study provides evidence to support government and development partners on the establishment and management of exclosures through identifying the benefits and drawbacks as perceived by different sectors of the community.

Keywords: Common Pool Resources; Degraded ecosystems; Exclosures; Institutions; Livelihoods, Sustainability.

Introduction

Common pool resources (CPRs) are natural and human constructed resources that benefits a group of people, but exploitation by one user reduces resource availability for others (Ostrom et al. 1994; Agrawal 2001). In the context of rural Ethiopia, common pool resources (CPRs) refer to forests, grazing lands, wetlands and other resources that have multiple users and/or user groups (Kebede 2002). “*The tragedy of the commons*” emphasized that communally managed resources could be overexploited by free riders (Hardin 1968). Hardin’s work contributed to natural resources management policies and practices promoting private over communal ownership. However, growing evidence suggests that user communities have prevented overexploitation of CPRs and improved benefit sharing by using self-governing rules which include formal (e.g. constitutions, laws, property rights) and informal (e.g. sanctions, taboos, customs, traditions, and codes of conduct) institutions (Ostrom 1990; North 1991; Agrawal and Gibson 1999). Both successes and failures have been reported and include reduced degradation of forest resources (Kumar 2002; Thoms 2008), reduced conflicts over natural resources (Yami *et al.* 2011), and improved income and livelihoods (Yemiru *et al.* 2010). In this line, the review by Cox *et al.* (2010) argues that sustaining the productive use of CPRs requires understanding the structure of the resource systems, the history of the people involved, the rules in use, the organizations involved, the amount of resource units harvested, and the conditions of the resource.

Scholars attempted to explain the requirements for sustainable management of CPRs from social, cultural, political, economic and ecological perspectives. Frameworks such as the design principles for robust institutions governing CPRs, the Inter-Institutional Gap (IIG) and

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the Institutional Analysis and Development (IAD) framework have also been developed to uncover the complex issues surrounding management of CPRs (McGinnis, 2011; Ostrom *et al.* 2005; 2011; Blomkvist and Larsson, 2013; Rahman *et al.* 2017). Some authors also suggest additions or changes to the frameworks (e.g. Clement 2010; Cox *et al.* 2010; Gari *et al.* 2017). In particular, the IAD framework has importance to analyze the relevant institutions to manage CPRs in a sustainable manner and has been used to examine management of fisheries and forests as CPRs, among others (e.g. Yandle 2008; Heikkila *et al.* 2011; Mehring *et al.* 2011; Mokhahlane and Obi 2011; and Senganimalunje *et al.* 2015). The IAD framework helps to understand the interrelations among CPRs, action situations which influence users' roles, responsibilities, access to/control over to CPRs and decision-making processes, the rules governing the interactions of users and or user groups, and the outcomes of CPRs management (Ostrom 2011).

In Ethiopia, deforestation, agricultural land expansion and overgrazing of landscapes threaten the sustainable management of communal forests (Mekuria *et al.* 2015). For instance, about 70% of the region of North-western Ethiopia experiences moderate to very high erosion and decline of forest resources (Meseret 2016). This situation is unfortunate in that communities in rural areas rely on CPRs such as communal forests and grazing lands for income and livelihoods. Accordingly, the establishment of exclosures as means to restore degraded lands has become common in the highlands of Ethiopia (Yami *et al.* 2013).

Exclosures are areas fenced to prevent livestock access and thereby promote natural forest regeneration (Muys *et al.* 2006). They are usually established in steep, eroded and degraded areas previously been used for grazing (Descheemaeker *et al.* 2009). The

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establishment of exclosures in the highlands of Ethiopia has mainly been driven by a conservation rather than a livelihoods agenda. The establishment of exclosures is usually initiated by government agencies or non-Governmental Organizations (NGOs), to combat degradation and reverse deforestation. Whilst communities are consulted, it is expected they will agree to such interventions (Lemeneh and Kassa 2014). Local communities, government and NGOs usually jointly delineate areas intended for exclosure, with the final decisions made at a general meeting of the watershed community (Yami *et al.* 2013). Grass harvesting, using a cut and carry system, honey production and medicinal plant collection by the community is permitted within exclosures. But exclosures often might not have locally contextualized management plans that include benefit sharing schemes in the short, medium, and long-term.

Past studies analyzed the influence of exclosures in improving the biophysical and socio-economic status of degraded watersheds in the northern and central highlands of Ethiopia (Babulo *et al.* 2009; Girmay *et al.* 2009; Descheemaeker *et al.* 2009; Mekuria *et al.* 2011). Comprehensive studies also exist on the benefits of exclosures (Muys *et al.* 2006; Oldekop *et al.* 2016), and “management, use, protection, benefits and drawbacks” of exclosures as well as the role and success of socio-cultural, political conditions and with the management approach (Wairore *et al.* 2015; Yami *et al.* 2013).

However, previous studies have paid little attention to whether local communities perceive exclosures as effective in restoring degraded landscapes and improving ecosystem services as well as livelihoods. Understanding how communities perceive the benefits and tradeoffs of exclosures is, however, important as that the communities exhibit heterogeneity

in access to land resources and have varied interests in CPRs use and management. Also, the drivers and costs of land degradation, and the perceived benefits of linked interventions, vary within local communities, and shape different responses to sustainable land use and management options.

The current study was conducted in the Gomit watershed, South Gondar, Ethiopia to examine the community perceptions on the land degradation problem, and benefits and tradeoffs of exclosures. The study employs the IAD framework to examine the perceptions of communities on managing exclosures as CPRs as suggested by Ostrom (2005, 2011). The paper examines perceptions on the biophysical condition (i.e., challenge of land degradation and restoration, e.g. Shylendra 2002), the action situations (i.e. user's access to and control over resources and decision-making processes towards taking actions in managing the exclosure, Ostrom 2005), actors' interactions (i.e. formal and informal institutions involved in the management of exclosures, e.g. Yami *et al.* 2013), and perceived outcomes (i.e., benefits and tradeoffs of managing exclosures, e.g. Balana *et al.* 2012). Finally, the paper presents implications of the results for national and regional land management processes across much of the North-western Ethiopia.

Methods

Study area

The study was conducted in the Gomit watershed in Amhara Regional State, northwestern Ethiopia (Fig. 1). The watershed covers 1,483 hectares and consists of 360 households with a total population of 1795 (Mekuria *et al.* 2015; Table 1). Agriculture is predominant livelihood mechanism as in other parts of the Amhara region. The sector consists primarily of

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smallholder farming, with average farm size of 0.82 hectare per household (Waesberghe and Mezemir 2010). Over 95% of the annual agricultural output is produced by cultivation of fragmented micro-holdings (Waesberghe and Mezemir 2010; Elias *et al.* 2013).

[Insert Table 1 here]

[Insert Fig. 1 here]

Major watershed land uses include cultivated land (23%), degraded secondary forest land (53%), communal grazing land (18%), and other uses (6%). Livestock production is an integral part of the farming system and contributes to the livelihood of the entire population. Livestock production depends on locally available feed resources. Main livestock feed sources are communal free grazing areas, crop residues, stubble grazing on cropland during the dry season / post-harvest, and hay (cut-and-carry system). However, unrestricted access and the decreasing trend of communal grazing lands results in overstocking (Tschopp *et al.* 2010), resource overexploitation and degradation (Benin and Pender 2002; Tschopp *et al.* 2010; Tilahun and Schmidt 2012; Moritz *et al.* 2013).

As part of the Sustainable Utilization of Natural Resources for Improved Food Security (SUN) program¹, the community established exclosures and constructed soil and water conservation (SWC) structures on 77.7 hectares between 2006 and 2013. The Gomit Watershed Association (GWA) has legal control over natural resource use and management and is formally registered under proclamation No. 1965 of 1960 of the Civil Code of Ethiopia 1990. The association obtained the legal power from the regional government (i.e., the Amhara Regional Government of Ethiopia) and they have their own Natural Resources Use

¹ The SUN program is a development program focused on natural resources management, which has been implemented by the Ministry of Agriculture and Rural Development with the support of the German Development Cooperation since 2005 (Waesberghe and Mezemir 2010).

(NRU) agreement legalized at zonal administrative level (i.e., the second highest administrative level). The GWA elected the Community Watershed Team (CWT), responsible for exclosure management, protection and use and other land rehabilitation efforts. The CWT consists of nine members, all of which are heads of households, seven men and two women. This gender imbalance can be mainly attributed to the relatively low number of women-headed households.

According to the three-year plan of the CWT (i.e., 2014-2016), 111.2 hectares would be enclosed by the end of the planning period. However, the plan provides no information on how long exclosures would remain protected, or on enhancing short-term economic benefits derived from exclosure establishment and management.

Data collection and analyses

Individual household surveys were conducted from September to November 2013, using a structured survey. Systematic random sampling of 58 households (16% of the 360 households) was undertaken (Table 1). The procedure used to select the respondents of household surveys included: (a) obtaining the list of households from Kebele level agricultural office, (b) selecting a household randomly to identify the starting point, and (c) selecting the 58 households by picking every 10th member in the list. It was not possible to balance the number of male and female participants in the study due to the limited number of women in decision-making positions and the limited accessibility of women for interviews due to their increased workload in the harvest season.

In addition, 25 key informants were interviewed. These were watershed management committee members, development agents, and forest users as well as management experts

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from a range of interests (district agricultural office, members of administrative bodies, women association committee members, agricultural production cadre members, elders, model farmers and German Corporation for International Cooperation (GIZ) staff). Key informants were selected in consultation with local administrative bodies and were chosen due to their active involvement in NRM initiatives, including community mobilization, construction of SWC structures, and afforestation and reforestation programs. They were included to strengthen, and triangulate information obtained from individual households.

Moderate variation was expected between key informants and household survey respondents, as differences exist in socioeconomic status, including education, occupation and income. However, variation was not expected to be extreme, as members of both groups share the same ethnic background, religion and norms.

Questions for the household surveys and key informant interviews focused on (1) the challenges of land degradation (i.e., extent, causes and consequences of land degradation); (2) the action situations (i.e., landscape rehabilitation efforts and their effectiveness; (3) actor's interactions in exclosure management (i.e., the role of institutions in exclosure managements); and (4) outcomes of exclosure management (i.e., the benefits and drawbacks of exclosure management and use). The questionnaires used for household surveys and key informant interviews are shown in Supplementary materials 1 and 2, respectively.

Qualitative data were analyzed using content analysis (Hsieh and Shannon 2005; Bernard 2006; Elo and Kyngas 2008). For qualitative analyses, the authors developed a coding scheme based on the main thematic areas including items such as the challenges of land degradation, rehabilitation efforts, exclosure establishment processes, institutions,

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benefits and drawbacks (Supplementary material 3). Then, deductive coding was employed using about 62 codes such as land degradation severity, types of causes, impacts (both biophysical and socio-economic), indicators for intervention effectiveness, participation level, law enforcement, and equity in benefit sharing. During the coding process, more codes were added when new issues emerge from the textual data. Besides, codes were merged, removed or modified to avoid repetition and resolve disagreements between codes. Descriptive statistics were used to summarize and compared with the quantitative data from individual household surveys and key informant interviews.

Results

The challenge of land degradation

Household survey respondents (hereafter referred to as respondents) and key informants had different views as to what degree land degradation is a problem. All respondents indicated land degradation was a critical problem versus 54 % of key informants. Perceptions on different forms and causes of land degradation, the community's indicators for land resources degradation, and how perception varied among different community groups are summarized in Table 2.

[Insert table 2 here]

Respondents had different opinions on the severity of different forms of land degradation (Fig. 2). For example, the severity of gully erosion was considered “very high” by 42% of respondents, whereas 71% considered severity of soil erosion on farmland “very high”. Both respondents and key informants identified negative consequences of land degradation, including soil fertility decline, reduction in crop and livestock production,

degradation of economically important tree species, erratic rainfall, increased temperature, and the drying out of springs and wetlands, as well as siltation of dams downstream. For example, a respondent elaborated on the severity of vegetation degradation:

“Following continuous and severe vegetation degradation, the composition of plant species is changing, and medicinal plants that we used to use to heal several diseases are disappearing.” (Translated from Amharic, Interviewee, household survey 2013).

[Insert Figure 2 here]

The majority (75%) of respondents mentioned land degradation affects men and women equally. Only 9 respondents (8 males, 1 female) mentioned unequal gender impacts. These respondents indicated that women are more affected by land degradation in general, and vegetation degradation in particular. In this line, one respondent elaborated:

“If vegetation in the surrounding areas is degraded, access to fuelwood decreases, and women will be forced to travel long distances to collect fuelwood and meet the demand for energy.” (Interviewee, household survey 2013)

The action situations

Respondents were aware of rehabilitation efforts, the reasons for intervening and the ultimate goals (Table 3); and agreed that interventions were effective in restoring degraded ecosystems and improving agricultural productivity. Exclosures with enrichment plantations (i.e., planting in vegetative areas) were considered the most effective NRM intervention (Table 3). Both respondents and key informant interviews perceived restoration efforts as effective and

mentioned similar indicators. For example, respondents elaborated on the effectiveness of exclosures:

“Before the implementation of exclosures, the uplands were degraded, and water erosion was severe. However, following the establishment of exclosures, we have seen that degraded lands were rehabilitated, migrating wild animals returned, survival rates of planted seedlings improved, excessive runoff was prevented, and water was retained for future use by plants.” (Interviewee, household survey 2013).

[Insert table 3 here]

All respondents were optimistic about the possibility of restoring degraded lands through exclosures and improving their productivity. However, respondents stressed that a joint effort among the local community, government and NGOs is required to reverse degradation and improve community livelihoods. In this respect, one respondent stated:

“There should be people and government integrity, and collaboration among different stakeholders for better implementation of exclosures. Also trust building among different stakeholders is key to enhancing local community participation and sustaining the benefits obtained from exclosures.” (Interviewee, household survey 2013).

Respondents felt the key roles of the local community should be to increase involvement in exclosure management and develop a sense of ownership. The government could utilize community mobilization and awareness raising, while NGOs could provide technical and financial support. The roles the three parties play in implementing, expanding

and sustaining exclosures, as perceived and based on respondents' opinion is summarized in Table 4.

[Insert table 4 here]

Respondents suggested that efforts should be made to increase short-term economic benefits of exclosures to motivate farmers to adopt long-term conservation approaches implemented in the watershed. This could be achieved through expanding or widely implementing integration of income-generating activities such as beekeeping and livestock fattening within exclosures. Furthermore, respondents suggested a need to increase local community members' awareness of the consequences of natural resource degradation and the importance of restoring degraded lands through the establishment and management of exclosures.

Actors' interactions in exclosures management

In the Gomit watershed, exclosure management involves local institutions such as governmental organizations (e.g., kebele administrators and district agricultural office), NGOs (e.g., GIZ) and CWT. Bylaws for exclosure establishment and management are usually developed jointly by the local community, the government and NGOs. Several bodies, such as CWT, kebele administrators, and district agricultural offices are involved in bylaw enforcement.

Bylaws mainly detail conditions for membership, criteria for hiring guards, and benefits and benefit sharing arrangements as well as when a community member should be fined and the amount. For example, members whose cattle enter exclosures or illegally cut

trees and harvest grasses can be fined. Fines range from 5 to 500 ETB², depending on the severity of the act, for example the frequency of violations or the size and age of trees cut. The key condition for membership is to participate in implementing NRM interventions in the watershed. The bylaws also specify schedules for meetings of the CWT and community members.

Respondents and key informants indicated that bylaws motivated local community members to be involved in exclosure management and reduced the overexploitation and degradation of CPRs, and reduced resource use conflicts. However, respondents underlined that bylaw enforcement was minimal where committee members are biased towards relatives who do not abide by the bylaws. For instance, one informant emphasized:

“The committee members sometimes ignore violation of bylaws by their neighbors and relatives. Yet, the committees punish others for doing the same thing, which is very unfair. Also, selective enforcement of bylaws increases corruption and reduces bylaw enforcement. Any rule will be a rule when it works on all, not when it is selectively enforced” (Key informant interviewee, 2013).

Outcomes of exclosures management

Most respondents indicated that exclosures improved ecosystem services and strengthened livelihoods (Table 5). For example, exclosures were effective in reducing soil erosion (mentioned by 75% of the respondents), restoring degraded native vegetation (69%), improving soil fertility (60%), and enhancing water availability (61%). They also believed

² One Ethiopian Birr (1 ETB) equals 0.053 US\$, based on the exchange rate on 23rd of October 2013; but changed to 0.03 on 30th April 2020. A visit by the first author to the study area during the months of March to June 2019 to consult members of the community to develop a business model scenario and suitability for exclosures (Mekuria *et al.* 2020) confirmed that the indicated fines were in use at the time.

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exclosures contributed to regulating rainfall and air temperature, and reduced runoff and flooding, provided shelter for wild animals and shade for animals and humans. Exclosures could also be used for recreation. The majority of respondents indicated exclosures enhance food and fodder production, non-timber forest products and household incomes (Table 5). Perceptions of the benefits and tradeoffs from exclosures were consistent across different community groups (Table 5). Respondents also indicated that exclosures have a positive influence on landless youth, as they created a favorable environment for beekeeping and grass production. In this context, one respondent elaborated:

“The regeneration of plants and improvements in vegetation composition following the establishment of exclosures motivated landless youth to organize themselves in cooperatives and engage in beekeeping and livestock fattening, and thereby improve their livelihood.” (Interviewee, household survey 2013).

[Insert table 5 here]

However, respondents and key informants underlined that exclosures also have negative effects, such as reducing fuelwood availability, and vegetation and soil degradation in remaining communal grazing lands and neighboring forest resources (Table 5). Such negative effects mainly arise from the increased livestock and human pressure on resources due to the protection of exclosures from livestock and human interference. According to 33% of respondents, conflicts among users usually arise whilst establishing exclosures, as expanding exclosures decreases communal grazing lands. Households having large numbers of livestock oppose exclosure expansion, as they restrict livestock movement and free grazing. Respondents indicated that exclosures could affect livestock production, either

positively or negatively, and that exclosures have a higher negative impact on small ruminants and oxen compared with cows.

Respondent opinions differed as to benefit sharing, in that 82% perceive both women and men benefit equally, the remainder that men benefit most. Respondents who perceived both men and women benefit equally stated that women benefited from incentives provided for community motivation (such as sheep). Secondly, women involved in the community as decision makers have direct representation of their specific interests. The provision of sheep for fattening usually targets women, as most activities related to sheep fattening can be done around homesteads, and women usually prefer to engage in activities around their homes. Respondents elaborated on the importance of incentives to improve benefit sharing, for example:

“Before the provision of incentives such as sheep to households headed by women, women farmers sold their grass share to relatively rich farmers at a low price. This led to a reduced interest among women farmers to participate in NRM activities, as relatively rich farmers benefitted more than women farmers. Following the provision of incentives, women farmers stopped selling grass to rich farmers, as they needed the grass to feed their livestock, consequently improving benefit sharing.” (Interviewees, household survey 2013).

Conversely, respondents who perceived men benefit most stated households headed by women usually had inadequate labor, with implications, for example, for the amount of grass that could be harvested. The results also demonstrated that for each ecosystem and

livelihood benefit obtained following the establishment of exclosures, there are beneficiaries and nonbeneficiaries (Table 5).

Discussion

The challenge of land degradation

Respondents and key informants had different views as to the degree land degradation is a problem, a discrepancy that may have arisen from different levels of involvement in decision-making processes related to NRM. In this line, the key informants are mandated to follow the day-to-day activities related to natural resources management. Such close involvement provided them the opportunity to recognize the extent of degraded ecosystems, changes following the implementation of the interventions since 2006 and the positive impacts of the implemented interventions. This finding agrees with the suggestion in the IAD framework that individual views and the way individuals acquire, process, retain and use knowledge could influence the information and the resources that individuals bring into the decision-making process in NRM (Ostrom 2011). Respondents' views on land degradation problems and its causes and indicators are consistent with views reported elsewhere (Kassa *et al.* 2013; Gashaw *et al.* 2014).

Respondents and key informants perceive population growth has a larger role in causing land degradation than factors such as poor land management, overgrazing and soil erosion. This could be attributed to their observation that population pressure has led to clearing less suitable land for agriculture and the cultivation of marginal lands, consequently resulting in severe land degradation (Fig. 3).

[Insert figure 3 here]

Differences were observed between young and adult respondents as to the major causes and indicators of degradation. This may be attributed to their differences in witnessing, for example, the degradation of forest resources over time. This finding validates the IAD framework in that community attributes such as heterogeneity in age, gender, experiences, and access to CPRs could shape the views of community members on the extent of degradation of the CPRs, and the actions required to address the challenge (Ostrom 2011). Many respondents from different community groups perceived crop yield reduction, soil erosion and vegetation degradation as major indicators of land degradation. Studies conducted elsewhere recorded similar results in that local communities use indicators such as crop yield decline (Moges and Holden 2007), soil erosion and loss of soil fertility (Davies *et al.* 2010), changes in vegetation composition and the disappearance of useful plant species (Macharia 2004) for assessment of land degradation.

The opinion of a few respondents that land degradation in general, and vegetation degradation in particular, has greater negative consequences for women than men should be noted. This argument arises from women being responsible for fuelwood collection, and vegetation degradation forcing women to travel long distances to collect wood, consequently reducing their productivity. Studies in Ethiopia and elsewhere have similarly shown that women tend to be disproportionately burdened by the indirect effects of land degradation (Eskonheimo 2006; Shambel 2012).

The action situations

Most local community members participated in ongoing rehabilitation efforts suggesting they were well engaged. Such observed engagement of the local community could increase

community members' acceptance of and confidence in government decisions, while also empowering members of the community (Heinman 1997). Additionally, the shared understanding of community members on the effectiveness of the rehabilitation could enhance their participation in collective action (Dyer *et al.* 2014). This point is reflected in one of Ostrom's design principles that inclusive decision-making processes with active engagement of the community members contributes to the sustainable management of CPRs (Ostrom 1990).

People in the Gomit watershed appeared optimistic that restoration of degraded ecosystems through different NRM interventions should be possible. This optimism could (a) expand rehabilitation efforts, (b) engage the local community in watershed management, and (c) restore degraded landscapes, a finding in line with work elsewhere (Ostrom 1990; SER-IUCN 2004).

Respondents' views on the importance of enhancing the short-term benefits of NRM interventions such as exclosures could arise from the fact that in poor communities, the incentive to extract short-term economic returns from land and natural resources often outweighs perceived benefits from investing in long-term environmental restoration, and related economic and ecosystem returns (Mekuria *et al.* 2020). This suggests that investment in land and natural resource restoration requires a balance between short-term economic returns and longer-term sustainability and environmental goals. Individuals, households and communities are more likely to accept or invest in activities that enable land rehabilitation over a long period of time, if there are immediate economic incentives to invest (Mekuria *et al.* 2020). In this line, Ethiopian and Kenyan studies (Kifle *et al.* 2014; Wairore *et al.* 2016)

demonstrated short-term benefits from exclosures can be enhanced through integrating beekeeping and livestock production. The IAD framework also suggested that costs and benefits assigned to an intervention dictate the interaction and exchange of goods and services among participants.

Actors' interactions in exclosures management

Community participation during the early stages of exclosure establishment, such as in community mobilization, plays an important role in several key aspects (e.g. enhancing joint decision making, developing mutual trust among different community groups and working toward achieving common goals). The management of exclosures with bylaws is also elaborated in Ostrom's design principles that participation in collective action, enforcement of rules to guide the use and management of CPRs, and using sanctions for violating the rules prevent exploitation and improve benefit-sharing among CPR users (Ostrom 1990). The involvement of both formal (e.g., district agricultural office), informal (e.g., CWT) and local (e.g., village level administrative bodies) institutions mobilizes the local community to establish and manage exclosures as well as for rule enforcement. Involvement of formal institutions could enable additional rule enforcement mechanisms, although caution is required to prevent conflicts with the bylaws and the rights of the beneficiaries to self-govern their resources (Ostrom 1990). As well, informal institutions should address the concerns expressed by a few respondents regarding benefit sharing and the consequences of land degradation.

Recognizing the importance as well as the implementation of bylaws for enclosure managements is seen as essential in addressing community motivation in relation to land degradation. Our results indicate that bylaws are important as they aim to prevent enclosure overexploitation. However, in our case, bylaws may not guarantee protection, as they focus on financial fines subsequent to encroachment. In Tigray, northern Ethiopia, local communities were motivated to address land degradation by establishing exclosures and devising village bylaws that shape their management and use (Yami *et al.* 2013). The motivation for strengthening enclosure management by using village bylaws arose from the poor performance of environmental reclamation programs conducted since the 1980s. The use of village bylaws to strengthen the management of exclosures could be attributed to the fact that informal institutions are effective and more respected by local people since they are adapted to traditional use rights and sanctions at the village level (Mehring *et al.* 2011).

Outcomes of exclosures management

Individuals in the Gomit watershed learned that exclosures improve ecosystem services, consistent with earlier studies (Mekuria and Aynekulu 2013). However, respondents' views on gender representation in benefit sharing and the distribution of benefits among different groups varied. Different views were also expressed on the type and magnitude of tradeoffs (Table 5). Differences in benefit sharing and distribution arose from the location of farmlands in relation to exclosures (Fig. 1), family size or labor availability and the lack of integration of exclosures with income-generating activities. The different views observed on the type and magnitude of trade-offs could be attributed to the beneficiaries' different experiences in resource availability (e.g., livestock holding, income from farm products), or availability of

alternative livelihood options (e.g., differences in engaging off-farm activities, homestead plantation) as exclosures are protected from human and livestock interference.

The high negative impact of exclosures on small ruminants and oxen compared with cows could be attributed to local communities' village bylaws allowing the grazing of cows within exclosures during calving and lactation. This suggests that bylaws favor the wealthiest farmers, as they often own more cows (Table 1). However, bylaws do not reflect traditional power structures and inequalities in this case since they aim at supporting the owners of milking cows in meeting higher feed demands.

The limited short-term impact of exclosures in improving smallholder income and livelihood hampers expanded exclosure use (Mekuria *et al.* 2020). Poorer households often value short-term economic benefits more than long-term returns (Mekuria *et al.* 2017). This situation could be explained by the limited emphasis given to the long-term environmental restoration and related economic and ecosystem returns in the guidelines used for managing exclosures. This could in turn discourage contributions of members of local community to collective action efforts in NRM, as suggested in the IAD framework (Ostrom 2011).

Thus, addressing local community concerns and enhancing the short-term benefits of exclosures is key. A joint effort among the local community, government and NGOs is needed to implement the roles and responsibilities of each (Table 4). This could facilitate a multi-stakeholder approach when establishing and managing exclosures and provide support to include all needs and interests of the different groups of the community. Also, such joint effort facilitates dialogue among the stakeholders and support the provision of incentives such as alternative energy sources and energy conserving technologies (e.g., solar power, biogas,

energy conserving stoves). Further, a joint effort could facilitate provision of technical support for improved agricultural practices and livelihood diversification mechanisms and enable successful integration and expansion of different income-generating activities with exclosures (e.g., integrating beekeeping and livestock fattening). These initiatives could reduce the impacts of exclosures on fuelwood availability and increase the short-term economic benefits of exclosures and sustain the interventions.

Implications

Realizing the multiple benefits of exclosures, the Ethiopian Government has committed to restore more than 7 million hectares by 2030 through their establishment. This study supports such commitment. The results appear generalizable to the north and north-western Ethiopian highlands, as the physical characteristics of the Gomit watershed and the remainder of the north and north-western Ethiopian highlands are generally comparable.

Restoring degraded landscapes through exclosures must balance short-term economic returns with longer-term sustainability and environmental goals. In poor communities, short-term economic returns from land and natural resources often outweigh the perceived benefits from long-term environmental restoration and related economic and ecosystem returns.

Increasing the short-term economic impacts of exclosures is key.

The consistent views of the different community groups on the causes and severity of land degradation, and the effectiveness of exclosures to restore degraded landscapes as well as the similarities between the responses of key informants and respondents is perhaps an opportunity to establish exclosures at a larger scale, restore degraded landscapes, and enhance agricultural productivity. The slight difference between the responses of key informants and

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respondents in severity of land degradation in the watershed would not affect the wider implementation of exclosures, as the difference attributed to witnessing the effectiveness of implemented rehabilitation measures to restoring degraded landscapes. The involvement of both formal and informal institutions contributes to mobilizing local community members for exclosure establishment and management and rule enforcement. To maximize the protection of exclosures, bylaws should not simply focus on financial fines, as these act only after encroachment have occurred.

The key lessons learned through this study towards managing and sustaining the productive use of CPR include: (a) understanding local communities' perceptions on CPR use, protection and management is crucial to design a management plan that fits with members of the communities managing their resources; (b) designing incentive mechanisms that enhance the short-term economic benefits of CPR supports to sustainably manage the resources; and (c) bylaws used to manage and protect CPR should focus on protective measures than financial fines to minimize encroachment and limit free riders.

Conclusions

This study has shown that for the given study site in upland Ethiopia, a region severely impacted by land degradation, the local communities are willing to engage and contribute to sustaining the productive use CPRs such as exclosures. However, some of the concerns of the local community need to be addressed through incentive mechanisms to enhance the participation of the local community towards managing exclosures. The study identified the benefits and drawbacks of exclosures as perceived by different sectors and actors in the local community. Such information could support the government and development partners to target interventions that improve benefit sharing among the different categories of the local community including marginalized groups. For instance, interventions such as integrating exclosures with income-generating activities including beekeeping and livestock fattening could help to address some of the community's concerns and contribute to sustaining exclosures. Enforcement of bylaws could also be strengthened to protect the exclosures from free riders, improve benefit sharing, reduce conflicts over resource use, and increase 'ownership' of exclosures by the local community.

Compliance with Ethical Standards:

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Conflict of Interest:

The authors declare that they have no conflict of interest.

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Table 1. Basic characteristics of the total beneficiaries and of sampled households in the Gomit watershed

Characteristics	Number and proportion		Sampled households*	
	No	%	No	%
Total households	360	100	58	100
Men-headed	270	75	49	84
Women-headed	90	25	9	16
Total population**	1795	100		
Men	772	43		
Women	682	38		
Children	341	19		
Age (years)				
< 15	449	25	N/A	
15-30	520	29	14	24
30-45	628	35	30	52
45-60	126	7	13	22
> 60	72	4	1	2
Farm size (ha)				
< 1	169	47	25	43
1 – 2	126	35	13	22
> 2	39	11	16	28
Landless households	26	7	4	7
Wealth category***				
Poor households	166	46	36	62
Middle income households	145	40	19	33
Relatively wealthy	49	14	3	5

*18 and 10% of men and women-headed households were sampled

**57% of the total population are women and children.

*** The classification of wealth category is based on farm size, income from sale of farm products, and number of cows and oxen. For example, the wealthiest groups own greater than 4 cows and 2 oxen, and having more than 2 hectares of land and get a minimum of 5000 ETB from the sale of farm products annually. The majority poor households own less than 2 cows and a maximum of 1 ox or having no ox. This group of the community own less than 1 hectare of land and get a maximum of 1000 ETB from the sale farm products annually.

Table 2 Characterization of land degradation by the local community in Gomit watershed

Variables	Local community's responses	Explanation	How perception vary among the different groups
Forms of land degradation	Soil erosion on farm and grazing lands; gully erosion; depletion of soil fertility; degradation of vegetation cover.	Mentioned by 95 % of the respondents.	The views of the different groups on severity of land degradation are consistent (SOM – Table 1).
Causes	Deforestation; overgrazing; poor land management; population growth; soil erosion by water and wind.	The two most important causes of land degradation were deforestation (mentioned by 63% of the respondents) and population growth (27%).	The views of the different groups are consistent. However, higher proportion of older respondents (73%) mentioned deforestation as a major cause than young respondents (38%). Similarly, 59% of poor and 33% of non-poor considered deforestation as a major cause.
Indicators for classifying a given soil or land as degraded	Features of soil erosion and loss of soil fertility; reduction in crop yield; stunted plant growth; stoniness.	Major indicators were reduction in crop yield (75%); soil erosion and loss of soil fertility (53%)	Equivalent proportions of respondents from the different groups mentioned reduction in crop yield and loss of soil fertility as major indicators.
Indicators for classifying severity of vegetation degradation	Scarcity of wood for fuel, construction materials and farm implements; lack of big trees; reduced vegetation cover; poor vegetation composition; increases in air temperature.	The two most frequently used indicators were reduced vegetation cover (73%) and lack of big trees (27%).	The difference between young and senior respondents was considerable on their perception of reduced vegetation cover as a major indicator (mentioned by 54 and 81%, respectively). Otherwise, the perception among the different groups was consistent.

Note 1: Poor land management refers to ploughing against contour, cultivating steep slopes without constructing soil and water conservation measures and removing crop residues from the field.

Note 2: Different groups of a community are gender, age, size of farm and wealth category (based on income from sales of farm products). Young respondents refer to those who are 15-30 years old, while old respondents are those who are 45-60 years old. Poor households refer to those who get less than or equal to 1000 Ethiopian birr from sales of farm products, while non-poor households are those who get more than 1000 Ethiopian birr.

Table 3. The local community's understanding of the rehabilitation efforts, reasons for the interventions and indicators used to assess effectiveness of the interventions in the Gomti watershed.

Interventions	Reasons for interventions	Indicators used by local communities to assess effectiveness	How perception vary among the different groups
Exclosures and enrichment plantations (considered effective by 40% of survey respondents)*	Restoring degraded landscapes and native vegetation	Increases in plant species richness and diversity; increases in the number and types of wildlife; increases in livestock feed; increases in household income; and increases in the availability of construction materials (e.g., woods for the construction of farm implements).	The views of the different groups on effectiveness of exclosures and enrichment plantations are consistent.
Terraces and micro basins (28%)	Restoration of degraded hills	Reductions in the amount of runoff and sediment loss; improvement in soil fertility; and increases in soil moisture.	The views of the different groups on effectiveness of terraces and micro basins are consistent.
Trenches (20%)	Harvesting water and improving soil moisture on agricultural lands	Increases in crop production, and reduced soil erosion by water.	The views of the different groups on effectiveness of trenches are consistent. However, trenches were considered effective by 29% of men respondents and 44% of women.
Construction of check dams (12%)	Mitigation of gullies	Reduced upward movement of gullies; reduced gully bank erosion and expansion; sediment accumulation; and reductions in runoff.	The views of the different groups did not show considerable variation.

* The % values in the bracket refers to the relative effectiveness of each interventions. Of the 91 replies on the effectiveness of interventions, for example, 36 replies (40 %) mentioned exclosures and enrichment plantations are most effective.

Table 4. The local community's opinion on the role of governmental, non-governmental and the local community in sustaining exclosures and reversing land degradation.

Role of the three parties		
Local community	Government	NGOs*
<ul style="list-style-type: none"> ▪ Increase their participation in exclosure management and develop a sense of ownership. ▪ Adopt improved agricultural practices (e.g., stall feeding and using improved livestock breeds). ▪ Reduce conflicts over the use of communal resources. ▪ Cooperate with government bodies and other stakeholders when implementing exclosures. 	<ul style="list-style-type: none"> ▪ Community mobilization. ▪ Awareness raising. ▪ Coordinate the support from different stakeholders. ▪ Provide training on improved agricultural practices. ▪ Improve benefit sharing. 	<ul style="list-style-type: none"> ▪ Provide technical and financial support. ▪ Provide improved technologies such as energy saving stoves, solar panels and improved seeds and livestock breeds. ▪ Support government bodies while providing trainings. ▪ Increase cooperation with government bodies and the local community when implementing exclosures.

*The financial support can be given through arranging long-term credit facilities.

Table 5. The local community's perception of the benefits and tradeoffs of exclosures

Provisioning ecosystem services	Effects of exclosures						Reasons/explanations	Beneficiaries	Non-beneficiaries	Remark
	Survey respondents (%; N= 58)			Key informants (%; N= 25)						
	(+)	(-)	No effect	(+)	(-)	No effect				
Food production	84.5	0	15.5	40	4	56	Exclosures contribute to reducing runoff, improving soil fertility, increasing soil moisture and improving the micro-climate. Increase in grass production following exclosure establishment.	All community members Households who have livestock	Members who do not own livestock*	Perception among the different groups was consistent. 100% of women respondents mentioned positive impact but considerable variation was not observed with other variables. 89 and 63% of women and men respondents indicated negative impacts of exclosures.
Fodder production	91.4	0	8.6	96	4	0				
Fuelwood availability	0	67.2	32.8	0	88	12	Access to fuelwood decreases. Also, exclosures aggravate the degradation of vegetation and soils in the remaining communal grazing lands and neighboring forest resources.	Mainly landless youth and women	Mainly women and children as well as households who do not have a backyard plantation.	100% women and 77% of young respondents mentioned positive impact.
Non-timber forest products	72.4	0	27.6				Non-timber products include grasses, fruits (e.g., Enkoy), habitat for wild animals, honey, and benefits from the improved aesthetic values. Unlike the survey respondents, the key informants mentioned that they are not aware of any kind of non-timber forest product that could be obtained from exclosures.			

* This is mainly due to the fact that members of a community who do not own livestock sell their grass share to the relatively rich farmers for cheap price, which consequently lead to unequal benefit sharing.

Figure captions

Figure 1. Location and land use map of the study area.

Figure 2. The local community's perception of the severity of the different forms of land degradation in the Gomit watershed.

Figure 3. Cultivation of marginal lands in the study area (*Photo: Wolde Mekuria*).





