



RESEARCH ARTICLE

CONTRIBUTION OF EXCLOSURE FOR ENVIRONMENTAL CONSERVATION AND COMMUNITY LIVELIHOODS IN THE CENTRAL RIFT VALLEY AREA OF ETHIOPIA

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ABSTRACT

Background: Exclosures are among degraded land rehabilitation strategies which are practiced in Ethiopia. However, due to lack of environmental and socio-economical virtues most exclosure are attributed negatively by local people and hence their sustainability left at risk. A study was carried out on two selected kebeles to investigate the effectiveness of exclosure in achieving the goal of environmental conservation and improving community livelihood strategy. Stratified random sampling was employed for the selection of sample households in two kebeles and they were surveyed using semi-structured questionnaires. Additionally, focus group discussions and key informant interviews were also administered. In all, a total of 96 households (70 non-participants and 26 participants) were interviewed. Data were presented in descriptive statistics.

Results: The study showed that the majority of the local communities living next to exclosure were dependent on subsistence farming system mainly crop cultivation and animal rearing, but a few were participated in exclosure activities as a means of their livelihood strategy. Conversely, a majority of the household heads (66%) had a wish to participate in exclosure developmental activities.

Conclusion: To ensure the sustainability of exclosure local community's participation and beneficiary involvement is mandated in almost all exclosure activities but it has not been proved very significant in practice. Therefore, rehabilitating of degraded areas by exclosure can be successfully realized through greater participation and involvement of the local communities, and it becoming environmental soundness, economic viability and social acceptability.

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INTRODUCTION

Land degradation is a serious global problem posing a threat to agricultural productivity, biodiversity, ecosystem stability and socio-economic functions of land resources (Stocking and Murnaghan, 2001). Land degradation is a severe problem across Sub-Saharan Africa and Ethiopia is among the most affected countries. In Ethiopia, due to the extreme dependence of the rural community on natural resources, particularly land, as a means of livelihood, the country is vulnerable for land resources degradation (EPA, 1998). Land use land cover changes, mainly agricultural expansion in response to the demands of population growth, has caused accelerated erosion and loss of biodiversity in Ethiopia (Hadgu *et al.*, 2008). The country experiences a loss of nearly 1.9 billion tons of top soil per annum per year, especially from the highlands (FAO, 1984, FAO, 1986). Consequently, it has significantly declined agricultural production with an estimated cost ranging from 2

to 6.75% of the Agricultural Gross Domestic Productivity (AGDP) per annum (FAO, 1986, Sonneveld and Keyzer, 2003). The current rate and status of environmental degradation still calls for more extended and coordinated intervention actions to rehabilitate degraded lands (Edward, 2000, Kindeya, 1997). In response to the problem of land degradation and other environmental problems, different natural resource conservation and rehabilitation interventions have been carried out in Ethiopia. The trend of rehabilitation made in different watersheds has improved ecosystem health and land productivity (Sonneveld and Keyzer, 2003). Accordingly, the government of Ethiopia has initiated a number of projects including soil and water conservation works and the establishment of exclosure with the financial assistance of international donors, mainly the World Food Program (Betru, 2003). Exclosure is a type of land management practice whereby livestock and humans are excluded from openly accessing an area that is characterized by severe degradation (Aerts *et al.*, 2009). The purposes of exclusion of animals and humans are to prevent further degradation of the ecosystems, advance re-vegetation/forest regeneration, and restore the

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overall ecological conditions of the areas. Enclosure is also known to improve ground vegetation covers, which in turn enhance better soil conditions, microclimate conditions and water percolation (Emiru *et al.*, 2006). Longer time kept area enclosures can facilitate large numbers of woody species to grow in to higher height and help woody species to have good population structure (Ambachew, 2006). Moreover, enclosures are known that they provide forest products including trees that can improve the livelihoods of the rural poor through increasing incomes, improving food security, reducing vulnerability and enhancing well-being (FAO, 2001; Hengsdijk and Jansen 2006). In addition to this, area enclosures is a quick and cheap method for the rehabilitation of degraded lands (Emiru *et al.*, 2003). As a result, rehabilitation of degraded lands through area enclosures recently received attention in many parts of Ethiopian especially in northern and central highlands (Kibret, 2008).

As a result, communities have started establishing area enclosures as a promising practice in different parts of the country with the aim of fighting against land degradation and promoting their re-vegetation to prevent further degradation (Emiru *et al.*, 2003). Nevertheless, in many cases success is obstructed by lack of clear management guide lines and consequently, communities did not benefited as expected. This is often manifested in communities' lack of decision making power in the management and utilization of the resources and limitation in the rights to use grass and wood produced in the area enclosures. This adversely affects the sense of ownership and community commitment for effective protection and sustainable management of the resources. It is argued that the problem is still not adequately addressed and communities are uncertain about the future of land tenure and land use policy. Consequently, various challenges have been faced on the effectiveness of enclosure management in the country. Based on these premises, this study was conducted to investigate the effectiveness of enclosure in achieving the goal of environmental conservation and improving community livelihood strategies in the central rift valley area of Ethiopia.

MATERIALS AND METHODS

The study area

The study was conducted in Lodesherbi and Qoro degaga *Kebele*, Dodota Woreda, Arsi Zone, which is about 130 km southeast of Addis Ababa and 30 kilometer from the capital city of Adama town, and 55 kilometers North of Assela, the Zonal capital (Fig.1). Geographically, it is located between $8^{\circ} 16'N - 8^{\circ} 20' 30.88''N$ latitude and $39^{\circ} 19'E - 39^{\circ} 20' 46.85''E$ longitude, lying between 1635 and 1795 m a.s.l. altitudes, and covering a total area of about 2436 hectares (OPEDB, 2000). The study area is characterized as dry tropical climate. The rainfall is bi-modal, with short rain season between April and June while the long rain season is between July and September. It receives a mean annual rainfall ranging from 500-700 mm. The mean monthly temperature is $25^{\circ}C$ with mean monthly maximum and minimum temperatures of $27^{\circ}C$ and $23^{\circ}C$, respectively. Based on the data obtained from the District Agricultural Office (OPEDB, 2000), the major land use types in the district include agricultural lands (17,744 ha), grazing land (5,331 ha), forest coverage (6,300 ha), water body (2,020 ha), sugarcane plantation (2,718 ha)+, park lands (2,500 ha), irrigation (560 ha), investment lands (215 ha) and built up

areas cover (7,172 ha). The major vegetation types of the study area are characterized by acacia woodland which includes species, such as *Acacia tortilis*, *Acacia oerfota*, *Acacia etbaica*, *Acacia Senegal* and *Acacia nilotica*. Moreover, other tree species like; *Solanium incanum*, *Solanium somalensis*, *Calpurnia aurea*, *Schinus molle*, *Dichrostachys cinera*, *Vernonia natalensis* and *Croton dichogamous*. The study area falls within the main Rift Valley area of Ethiopia. According to the information from (OPEDB, 2000), the major soil types in the district include Cambisols (45%), Leptosols (35%) and Andosol (20%) with Leptosols as the dominant soil type in the study area mantling the sloping topography. These soils are characterized by whitish color and shallowness in their depth (less than 25 cm depth) overlying hard bed rocks.

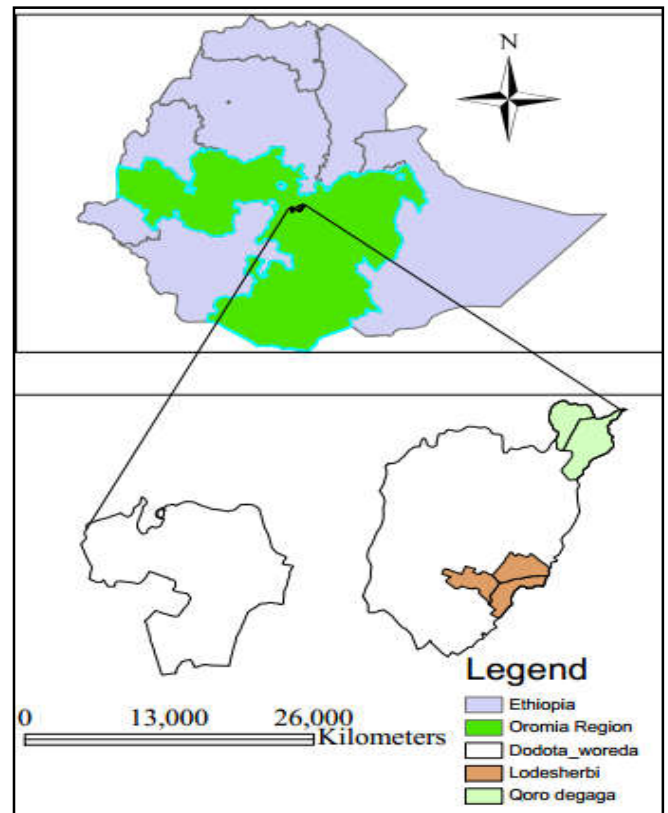


Figure 1. Location of the study area

Data collection and analysis

Both primary and secondary data were collected for the purpose of this research. Primary data were obtained from the household survey through structured questionnaire, focus group discussion and key informants interview based on set of questions in relation to the study objectives. Checklists were prepared for gathering information from key informants and for the focus group discussion. On the other hand, secondary data were obtained from various documents such as, published & unpublished sources and an internet explore. Preliminary survey was conducted to have an overview of the condition of the areas to the selection of specific study sites and household heads. Then, two kebeles namely Lodesherbi and Qoro degaga were selected purposively for the study based on the extent of the severity of problems related to enclosure management and their proximity of the enclosure. Accordingly, a total of 96 household heads were administered and ten key informants and ten for focus group discussion were included from both kebeles. The households were selected using stratified random sampling techniques from non-participants and participants, as

it was assumed that the perception and attitude of local community towards the enclosure activities, is significantly affected by their participation. A semi-structured questionnaire was distributed to 96 households, 26 participants and 70 non-participants in enclosure activities.

Statistical analysis

To analyze the data, both qualitative and quantitative data analyses tools were used. The collected data was coded, interpreted and synthesized using Statistical Package for Social Sciences (SPSS) software Version 22. For the qualitative data, narration and explanatory methods of data analysis were used. Chi-square test was used to assess whether any significant differences exist between demographic variables and residents perceptions and attitudes towards the enclosure development of the area.

RESULTS

Household socio-economic characteristics

Out of the total household heads (N=96) interviewed, 27% were participant and 73% non-participant in enclosure activities. 64.6% were males and 35.4% were females. Eighty four were married (87.5%), 1.04% single, 9.38% widowed and the rest 2.08% were divorced. The family size of the households surveyed ranged between 1 and 9 persons with an average size of 8 persons per household. Of all, 57.3% household heads had primary education, 20.8% were illiterate while about 21.9% had secondary education. In terms of age, 54% of household heads were above 35 years and 46% of household heads below 35 years. The majority of household heads (56%) were poor (household heads who reported insufficient annual income to support basic household expenditures such as for food and clothing), while 39% were classified as medium and 5% were rich.

Livelihood strategies adopted by local communities

As shown in Table1, crop cultivation and animal rearing were the main livelihood strategies adopted by the community living around enclosure. From the responses, the majority of the household heads were survived on crop farming (91%) and livestock rearing (86%). On the other hand, a small number of the local communities were involved in enclosure activities such as, bee keeping, selling grass/thatch, fuel wood and participating as daily labour (Table 1). The major agricultural crops cultivated in the area were Barley (*Hordeum* sps.) and Wheat (*Triticum aestivum* L.) and vegetables including Potato (*Solanum tuberosum*), Cabbage (*Brassica oleracea* L.) and Onion (*Allium* sps.). While, the most numerous livestock kept by the community were Cattle, Sheep, Donkey and Goats.

Table 1. Livelihood activities of the local people living around Enclosure

Types of activities	Frequency	Percent
Crop farming	87	91
Livestock rearing	83	86
Participating as daily labor	9	10
Bee keeping	5	5
Selling grass/thatch	2	2
Fuel wood	1	1

Benefits of enclosure for local communities

Enclosure was found to have direct and indirect benefits to the local communities. The benefits of enclosure to the local communities are categorized as economical, social and ecological. Enclosure as a source of employment opportunities and as a means of direct income sources through employment, selling grass/thatch, beekeeping, harvest non-timber forest products, and others were perceived as most direct economic benefits by household heads. As a result, the majority of the household heads (68%) noted that the enclosure did create employment opportunities for local communities which could bring good income source to the communities, through employment and other (Table 2). Accordingly, local communities also accepted enclosure benefits through restore degraded areas to harvest forest products such as grass/thatch, fodder, dead fire woods and engage out in various services. However, the establishment of enclosure alone did not reduce the extent of soil erosion (uncontrolled flood); this is due to the previous intensive farming practices next to enclosure.

Community contribution in conservation of enclosure

The results of the present study confirm that the greater part of the household heads were engaged in conservation activities by protection of illegal/open grazing (64%) followed by participate in physical conservation works (53%) in the enclosure, 23% helped providing information about illegal activities noticed in the enclosure (Table 3). The communities were also involved with the work of boundary demarcation and fence construction around enclosures to protect the local people from illegal grazing. It was learned during the focus group discussion that local communities participated in several conservation activities in the enclosure, especially in protection of illegal grazing, and providing information about any illegal activities were observed. However, 4% of the household heads were not involved in any kind of conservation activities in the enclosure (Table 3).

Community participation in enclosure activities

Among the sampled household heads, 66% of the household heads did not participate in any of enclosure activities, while 34% did participate in some form of enclosure activities. From those household heads who had participated, (11%) were involved in expansion of enclosure and (9%) in planting different plant species. Local communities also participated in protect and maintain the existing enclosure. It was also necessary to know the communities that showed the highest interest of involvement in the enclosure activities. Almost all of non-participants (90%) showed willingness to participate in enclosure activities such as protect and maintain the existing enclosure and as a daily labor. Such information is critical to protect and maintain the existing enclosure and other services in the future (Table 4).

Community awareness towards the role of existing natural resources

The majority of household heads (79%) agreed that the existing natural resources of enclosure was an important water source for the communities, 19% said as less important and 2% said no important. The local communities understood that the enclosure is important for environmental conservation (79%) and rest found it less important and not at all important.

Table 2. Response to the statement regarding exclosure benefits by those who were participant and non-participant in exclosure activities carried out

Benefits	Response	Respondents						Ch-squared significance (P)
		Non-participant		Participant		Total		
		No.	%	No.	%	No.	%	
Employment opportunity	Yes	42	61	23	88	65	68	<0.002
	No	28	39	3	12	31	32	
Harvest forest products	Yes	37	53	23	88	60	63	<0.001
	No	33	47	3	12	36	37	
Restore degraded areas	Yes	49	70	15	57	64	67	<0.005
	No	21	30	11	43	32	33	
Linkage with education sector	Yes	21	31	11	43	32	33	<0.182*ns
	No	49	69	15	57	64	67	
Reduced soil sediment (uncontrolled flood)	Yes	19	27	14	53	33	34	<0.006
	No	51	73	12	47	63	66	
Experience exchange between expert and local people	Yes	21	31	15	57	36	37	<0.007
	No	49	69	11	43	60	63	
Conserve medicinal plants	Yes	47	67	16	62	63	66	<0.163*ns
	No	23	33	10	38	33	34	

*ns= not significance at $\alpha=0.05$ **Table 3. Local communities involvement in exclosure development and conservation (N=96)**

Activities	Frequency	Percent
Protection of illegal/open grazing	61	64
Participate in physical conservation works	51	53
Provision of information about illegal activities	22	23
Fence construction	4	4
Boundary demarcation	4	4
No involvement	4	4

Table 4. The proportion of respondents participated and wishes to be participated in the exclosure

Factors	Response	Respondents					
		Non-participant		Participant		Total	
		No.	%	No.	%	No.	%
Community participation in exclosure	Yes	7	10	26	100	33	34
	No	63	90	0	0	63	66
Nature of participation in exclosure activities	Protect and maintain the existing exclosure	0	0	7	27	7	7
	Expansion of exclosure	4	6	7	27	11	11
	Planting d/t species	1	1	7	27	8	9
	Grass/thatch selling	0	0	5	20	5	5
	Fuel wood collection	2	3	0	0	2	2
People wish to participate	Not involved	63	90	0	0	63	66
	Yes	63	90	0	0	63	66
Wishes of the community to be involved	No	7	10	26	100	33	34
	Protect and maintain the existing exclosure	18	26	0	0	18	19
	Ecotourism	37	53	0	0	37	39
Wishes of the community to be involved	As daily labor	8	11	0	0	8	8
	Already involved	7	10	26	100	33	34

Table 5. The role of the existing natural resources to local communities

Exclosure as a source	Response	Respondents					
		Non-participant		Participant		Total	
		No.	%	No.	%	No.	%
Water access	Important	56	80	20	77	76	79
	Less important	12	17	6	23	18	19
	Not important	2	3	0	0	2	2
Environmental conservation	Important	54	77	22	85	76	79
	Less important	12	17	3	11	15	16
	Not important	4	6	1	4	5	5
Cutting grass for domestic animals	Important	27	39	12	46	39	41
	Less important	24	34	10	39	34	35
	Not important	19	27	4	15	23	24
Dead wood collection for fuel	Important	17	24	4	15	21	22
	Less important	21	30	13	50	34	35
	Not important	32	46	9	35	41	43
Bee keeping	Important	53	76	13	50	66	69
	Less important	14	20	10	38	24	25
	Not important	3	4	3	12	6	6

Table 6. Awareness and effectiveness of exclosure development for nature conservation

Factor	Response	Respondents						X ² (p)
		Non-participant		Participant		Total		
		No.	%	No.	%	No.	%	
Awareness	Yes	27	39	16	60	43	45	P<0.036*
	No	43	61	10	40	53	55	
Effectiveness	Effective	27	39	9	34	36	38	
	Less effective	18	25	10	37	28	29	
	Not sure	15	21	4	15	19	20	
	Not effective	10	15	3	14	13	13	

*=significant at $\alpha=0.05$

Table 7. Sensitisation of local communities for environmental conservation

Kinds of sensitisation	Respondents						X ² (p)
	Non-participant		Participant		Total		
	No.	%	No.	%	No.	%	
Importance of forest for environment	34	49	11	42	45	47	P<0.009*
Conservation of exclosure ecosystem	24	34	12	46	36	37	
Avoid illegal harvesting of forest	9	13	3	12	12	13	
Conservation of endemic animals	3	4	0	0	3	3	

*=significant at $\alpha=0.05$

Accordingly, the community perceived that the exclosure resources to be important for grazing of their animals (41%), less important (35%) and not important for grazing of their animals (24%). The existing natural resource of the exclosure is important for fuel collection responded by 22%, less important by 35% and 24% not important.

Awareness and sensitization among local community about exclosure

Of all household heads, 45% replied that they were aware about exclosure development activities in the area whereas 55% were not aware of these activities. The household heads when asked about the effectiveness of sensitization of exclosure in reducing illegal activities in the exclosure, 38% responded it was effective, 13% not effective, 29% said less effective and 20% said not sure (Table 6). When asked about what types of sensitizations they received by the exclosure, 47% were sensitized about the importance of forests for environmental conservation and this helped changing their attitudes towards conservation of forest, 37% were sensitized of conservation of exclosure ecosystems and 13% were sensitized about avoiding illegal harvesting of forests in the exclosure. The other sensitizations given to local communities were conservation of endemic animals.

DISCUSSION

Livelihood strategies of local communities

The livelihood strategies practiced by local communities in the study area showed that household heads directly participated in exclosure, and of those not involved directly; most have as their main livelihood activity, subsistence farming which includes crop cultivation and animal rearing. Local community members participating in exclosure activities were engaged in off-farm activities such as bee keeping, collecting dead fuel wood and selling grass/thatch. They were also employed as day labor. This indicates that there are off-farm options connected to exclosure for supplementing their livelihood options. Although, people participating in exclosure usually depend on agriculture as their source of main livelihood since

exclosure in the area is not well developed and there is low income generation. Results of the present study showed that more than 91% of the local people were practicing crop cultivation and more than 86% were dependant on livestock rearing. WWF (2001) finding supported this assumption that more than 95% of people were dependent on agriculture-based occupation in buffer zones of protected areas. However, agriculture was not changed the community livelihoods in Nepal, this is due to its contribution on daily needs at the buffer zone of protected area (Timilsina, 2007).

Exclosure contribution for community

Exclosure is an important source for environmental conservation, source of income generation and improvement of local livelihoods in the developing countries of the world. Exclosure can offer a viable alternative for livelihood improvement in the project areas such as selling of grass, daily labor, harvesting grasses from the exclosures for their livestock feed & thatching or roofing their huts, conservation of existing woodland and a reduction of soil erosion after establishments of exclosure. Muys *et al.* (2006) demonstrate that many rehabilitated areas contribute to a good deal of annual income of local community. Particularly, products from forest environmental sources contribute significantly to rural households' economic wellbeing (Monica, 2004). In the study area, data analysis from the sampled households' response shows that income from exclosure products contributes 3% of the total average annual household incomes. Similar to this finding, another study conducted in Dendi woreda of western Ethiopia also pointed out that exclosure generated 39% to average household income (Getachew *et al.*, (2007). In response to these positive impacts, communities in the Central Rift Valley area of Ethiopia have started to establish exclosures before three decades ago.

Community participation in conservation of exclosure

Active participation of local communities in exclosure development plays a significant role in providing them with financial benefits for enhancing their livelihoods (Brian, 2007). The local community in the study area was involved in different conservation activities of the exclosure but was not

involved significantly in enclosure planning and management decisions. Betru *et al.* (2005) stated that in most enclosure, short term benefit of local people are forage and thatching grasses and their care depend on the availability and sustainability of these grasses through local people's participation in both the planning and implementation phases of the project. The community in the study area was participating in protection of illegal/open grazing; participate in physical conservation works, provision of information about illegal activities, fence construction and boundary demarcation. Community participation is very effective methods to realize the conservation of enclosure destinations through developing the economy of local communities (Emiru *et al.*, 2006, Betru *et al.*, 2005). The local communities also participated in different enclosure activities such as protect and maintain the existing enclosure, expansion of enclosure, planting different plant species, grass/thatch selling and fuel wood collection. In most enclosure of Ethiopia especially Tigray, access to fuel wood and other woody products is prohibited (Mekuria *et al.*, 2009, Emiru *et al.*, 2006). Conversely, controlled forage and thatching grass are legally accessed resources in most enclosures and became decisive factors for local community to give value to enclosures and to maintain sustainably (Tsfay, 2011, Betru *et al.*, 2005).

Enclosure for environment conservation

Enclosure has greater ecosystem, and provides a host of benefits on a local and national level. However, little is known about the importance of the existing natural resources to the various stakeholders. Local communities participating in different enclosure activities ensure an employment opportunity which is viewed as an important element for environmental conservation. Provision of benefits to communities adjacent to protected areas through income generation and employment opportunity is an important environmental conservation tool. Enclosure in natural areas often places to halt and reverse land degradation to check the adverse effect of runoff, improve the micro climate and create conducive atmosphere for humans and livestock by maintaining environmental stability in the trees, shrubs, herbs and grasses (Mengistu *et al.*, 2005). Similarly, Mengistu *et al.*, (2005) ascribed, in many of closures springs have been revitalized and water tables have been raised, land cover is improved appreciably and gullies are disappeared after the enclosures. Thus, enclosure is a more sustainable development strategy, protecting the ecosystem and at the same time serving as an income and employment provider for the local community. The communities understood that the enclosure is important for environmental conservation such as control soil erosion and silting of water resources, getting reliable rainfall; improve ground water recharge and others. Descheemaeker (2006) stated that the existence of enclosure has contributed greatly to the conservation of an area's natural resources. Since the enclosure activities are source for revenue earning for local communities they developed attitude towards the conservation of their natural resources and also helping with the reduction of negative impacts on the environment and its degradation and destruction through conserving the natural resources.

Conclusion

Direct and indirect benefits of enclosure would encourage local people's commitment and needs for supporting future interventions and management strategy, and ecological

rehabilitations for the sustainability of enclosures. As a result, collaborative natural resource management is very essential to ensure the sustainability of environmental conservations and socioeconomic wellbeing of the society.

Author contribution

GA: participated in designing the research idea, field data collection, data analysis, interpretation and report writing; read and approved the final manuscript.

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Endnote

A Kebele is the lowest government administration structure in the country.

Competing interests

The author confirms that no one has any competing interests in the manuscript.

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