

Exclosures in people's minds: perceptions and attitudes in the Tigray region, Ethiopia



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ABSTRACT

The paper examines the perceptions and attitudes of local people living next to nine exclosures in the Tigray Region in Ethiopia. Social exchange theory was used as theoretical framework and data were collected from 446 farming households. Factor analysis, multiple linear regression and binary logistic regression were applied to the data to identify factors that influenced local household heads' perceptions of and attitudes towards existing exclosures and further expansion of exclosures. Household heads' perceptions of exclosures could be grouped under social, economic and ecological dimensions. Some household heads expressed positive attitudes towards the existing exclosures, while some were concerned about the future expansion of the exclosures. The findings also revealed that households' socio-economic profile, households' knowledge about exclosures, the ecological conditions of exclosures, and the geographical attributes of exclosures all played important roles in shaping local household heads' perceptions of exclosures. Moreover, their perceptions of exclosures were significantly correlated with tangible benefits and costs associated with exclosures. Thus, improvement in local communities' attitudes towards and support for exclosures would follow if exclosures contributed more directly to people's livelihoods. However, the level of support for exclosures is remarkable given the fact that they have been closed for grazing and other uses.

1. Introduction

The establishment of protected areas is the cornerstone of land rehabilitation in different parts of the world (Allendorf, 2007; Allendorf et al., 2006; Amin et al., 2015). In the Tigray Region in Ethiopia, land degradation is addressed by closing off the most degraded grazing lands and forests from cultivation, grazing and firewood collection, in order to form exclosures (Aerts et al., 2009). The exclosures are protected by guards and local communities' bylaws (Mekuria et al., 2007). Thus, they can be categorized as protected areas (Aerts et al., 2009). Natural resources such as forests and grazing lands are multidimensional, and a number of actors with different and sometimes conflicting interests are involved in the management of such resources (Krott, 2005; Nurrochmat et al., 2017). Some actors prioritize conservation and protection of natural resources through land rehabilitation projects (Nurrochmat et al., 2017), some are interested in the illegal harvesting of commercial products such as timber (Nurrochmat et al., 2017), and some derive their livelihoods from these resources (Babulo et al., 2009;

Mamo et al., 2007; Soltani et al., 2014). Although all of the aforementioned actors are affected by policy measures or management interventions that restrict their access to forests and grazing lands, local communities living close to such resources are comparatively more vulnerable to the interventions. Additionally, the local communities suffer directly as a result of land degradation. Therefore, those who are dependent on forests and grazing lands should be given an opportunity to have a say in their provision (Breton, 1965). Originally, the primary purpose of the establishment of exclosures was to enhance environmental regeneration in degraded areas (Gebremedhin et al., 2003). Later, it was recognized that protected areas and exclosures should contribute to sustain the livelihoods of local communities living adjacent to resources (Charnley et al., 2007) because they are key stakeholders who actively use, manage and change their surrounding environment (Muhamad et al., 2014).

There has been consensus among scholars and politicians that the long-term success of any protection program will depend on the support of local people (Vodouhê et al., 2010), and their perceptions of and

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positive attitudes towards conservation (Struhsaker et al., 2005). People's perceptions reflect the beliefs that they derive from their experiences and interactions with a particular phenomenon (Htun et al., 2012). The term "attitudes" has been used in relation to positive or negative responses towards an entity or object (Karanth et al., 2008) and is defined as a mental evaluation of a particular entity with some degree of favor or disfavor (Eagly and Chaiken, 1998). Attitudes are formed through individuals' perceptions and experiences (Infield and Namara, 2001). Studies of attitudes and perceptions have contributed to the identification of local communities' needs and aspirations, the documentation of their ideas and opinions regarding conservation, and the understanding of why local communities make particular decisions and behave in certain ways. The results of surveys of attitudes and perceptions have indicated the implications for local communities that live adjacent to protected areas, and which factors influenced their attitudes towards protection and support for such protection. Such knowledge is important to ensure that efficient protection policy measures are taken (Kaltenborn et al., 2006), such that both protection goals and local demands for ecosystem services are fulfilled (Harterter et al., 2012).

In recent years, there has been an increase in the number of studies of perceptions and attitudes among local communities living adjacent to protected areas in developing countries. Some studies have dealt specifically with local people's perceptions of forest conditions, ecosystem services and protected areas (e.g., Adhikari et al., 2014; Amin et al., 2015; Dolisca et al., 2007; Ezebilo and Mattsson, 2010; MacKenzie et al., 2017; Min et al., 2018; Muhamad et al., 2014; Paudyal et al., 2018; Permadi et al., 2018; Shahbaz et al., 2011; Stickler et al., 2017; Sullivan et al., 2017; Vodouhê et al., 2010; Yaoitcha et al., 2015), while others have examined local communities' attitudes towards conservation and management of protected areas (e.g., Allendorf, 2007; Allendorf et al., 2006; Badola et al., 2012; Chuang and Yen, 2017; Dewu and Røskaft, 2018; Grilli et al., 2016; Guo et al., 2014; Infield and Namara, 2001; Kaeser and Willcox, 2018; Kideghesho et al., 2007; Rahman et al., 2017; Tomičević et al., 2010). Some researchers have analyzed the interests, influence and power of different actors involved in the management of protected areas and community forestry (e.g., Nurrochmat et al., 2017; Schusser et al., 2015), and have reported that the perceptions and attitudes of local communities toward conservation issues and protected areas are strongly influenced by their "intrinsic" or true interests, although they are often hidden (Nurrochmat et al., 2017). By contrast, few studies have assessed local communities' perceptions and attitudes towards conservation issues and protected areas (e.g., Htun et al., 2012; Hussain et al., 2016; Nurrochmat et al., 2017; Xu et al., 2006). These include a number of studies conducted specifically to examine local communities' perceptions and attitudes towards conservation and protection issues in Ethiopia (Bessie et al., 2014; Birhane et al., 2017; Mekuria, 2013; Moges and Taye, 2017; Tadesse and Teketay, 2017; Tesfaye et al., 2012; Tessema et al., 2010). The diversity of factors determining local communities' perceptions of protected areas and their attitudes towards such areas has made it necessary to develop a theoretical framework. Only few of the studies of local perceptions of and attitudes towards protected areas are based on or concerned with theory (Chuang and Yen, 2017; Kaeser and Willcox, 2018; Nurrochmat et al., 2017; Tesfaye et al., 2012). The use of social exchange theory (Turner and Turner, 1978) in the present paper is an attempt to address the shortcoming by providing a theoretical orientation.

Homans (1958) developed social exchange theory to understand human behavior and explain human interactions. Later, Emerson (1962) and Blau (2017) extended Homans' theory to analyze how individuals and organizations interact to maximize their gains and minimize their costs. The extended theory describes how people develop attitudes towards an object (a person or thing) based on their subjective cost–benefit analysis and comparison of alternatives. Objects that generate net benefits are more likely to be perceived positively,

while those associated with net losses will tend to be perceived negatively (Napier and Napier, 1991). The theory outlines that individuals will engage in an exchange if they believe the cost of the exchange does not outweigh the resulting benefits (Skidmore, 1979). The cost of exchange can appear in form of time, money or energy (Kelley and Thibaut, 1978), whereas benefits can be goods, information, services, money, or status (Emerson, 1962).

We aim to add to the literature on local perceptions of and attitudes towards protected areas in three ways. First, a narrative of success has dominated the discourse of exclosures in Tigray (Birhane and Hadgu, 2014; WeForest, 2018; Whiting, 2017): local communities together with district offices of the Tigray Bureau of Agriculture and Rural Development have established exclosures throughout the region, and the results have been very encouraging. The environment has been improving to the benefit of people's livelihoods. This narrative seemed too good to be true, and therefore we examined local farming household heads' perceptions of the various impacts of exclosures and their attitudes towards exclosures to enable us to test the hypothesis that local communities have supported the establishment and expansion of exclosures despite the limitations imposed on their access to forests and grazing lands. Second, we present a case from the Tigray Region, where few studies of local communities' perceptions and attitudes have been conducted to date. Third, our research has provided a theoretical orientation that can integrate previous findings and lead to a better understanding of how local communities perceive the various impacts of exclosures and why they develop positive or negative attitudes towards exclosures. We applied social exchange theory and analyzed data from 446 households living adjacent to 9 exclosures in Tigray. The objectives of our study were (1) to identify local household heads' perceptions of exclosures, (2) to identify local household heads' attitudes towards existing exclosures and further expansion of exclosures, and (3) to determine factors that influenced local household heads' perceptions of exclosures and their attitudes towards existing exclosures, and the expansion of exclosures. Hereafter, this paper is organized as follows. In Section 2, we present a theoretical framework based on a literature review and describe the study sites as well as the methods of data collection and data analyses. Then, we present the results of our study followed by our discussion in Section 3, and finally conclusions in Sections 4.

2. Methods

2.1. Conceptual framework

From the perspective of conservation and protection, we assume that the establishment of any protected area represents an exchange. According to social exchange theory, there are costs and benefits associated with any exchange (Cropanzano and Mitchell, 2005). The balance between positive perceptions of benefits from protected areas and negative perceptions caused by the costs will determine whether people support the establishment of protected areas. Fig. 1 shows the conceptual framework of the study. Household heads' evaluation of benefits and costs associated with exclosures formed the core of the framework. Several variables affected the way household heads evaluated benefits in relation to the costs. These variables were identified through a literature review of studies examining local communities' perceptions of and attitudes towards protected areas. The variables are summarized in Table 1 and described in the following.

2.1.1. Tangible benefits and costs associated with exclosures

Previous studies have found that local communities' perceptions and attitudes depend on the tangible benefits obtained from protected areas (Allendorf, 2007; Allendorf et al., 2006; Baral and Heinen, 2007; Dewu and Røskaft, 2018; Htun et al., 2012; Infield and Namara, 2001; Kuvan and Akan, 2005; MacKenzie et al., 2017; Tessema et al., 2010; Vodouhê et al., 2010; Walpole and Goodwin, 2001; Xu et al., 2006),

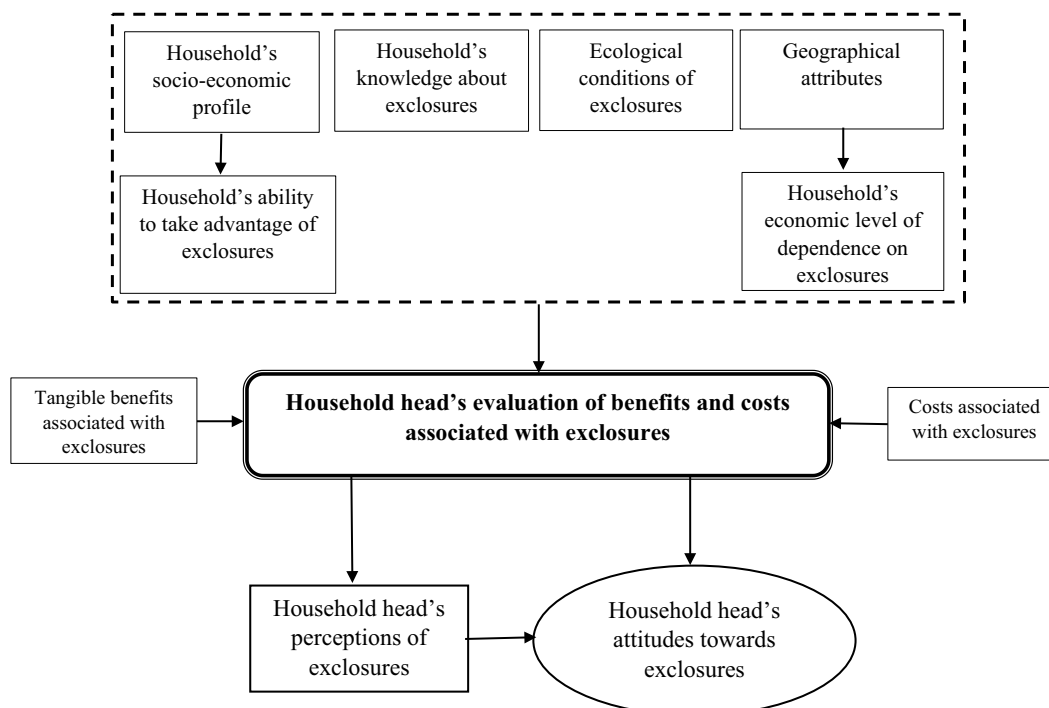


Fig. 1. Determinants of local household heads' perceptions of and attitudes towards exclosures based on social exchange theory.

compared with the cost of living adjacent to such areas (e.g., Dewu and Røskaft, 2018; MacKenzie et al., 2017; Walpole and Goodwin, 2001; Xu et al., 2006). In our analysis, we used a dummy variable named “household’s harvest status” as a proxy for tangible economic benefits obtained from exclosures, with code 1 if the household obtained outputs from the exclosures, and code 0 (zero) otherwise. Regarding the costs associated with the establishment of exclosures, we constructed a categorical variable termed “household’s level of duty.” The people

living adjacent to the exclosures had to participate in a number of protection measures, and their level of duties represented the effort each household had to invest in the exclosures. Some examples of the protection measures are digging pits, planting seedlings, and constructing stone bunds, soil bunds, and terraces to reduce runoff. We defined three levels for the variable: 1 = no assigned duty (households not assigned to any of the protection duties), 2 = low assigned duty (households having only one of the protection duties), and 3 = high

Table 1
List of explanatory variables and their definitions.

Variables	Definition
Tangible benefits and costs associated with exclosures	
Household’s harvest status	Dummy variable with code 1 if the household collected outputs from exclosures, otherwise code 0
Household’s level of duty ^a	Categorical variable with three levels: 1 = no assigned duty (households not assigned duty), 2 = low assigned duty (households involved in more than one duty), 3 = high assigned duty (households involved in more than one duty).
Household’s socio-economic profile	
Gender of the household head	Dummy variable with code 1 for male-headed household, otherwise code 0
Log of age of the household head	Age of the household head in years
Average education of the household	Average number of years of schooling completed by household members
Number of laborers in household	Number of household members in the age range 15–64 years
Household’s cropland area	Size of household’s own land for agriculture in ha
Household’s herd size	Number of tropical livestock units (TLUs) owned by household, calculated as 1 goat = 0.13 TLU; 1 sheep = 0.13 TLU; 1 chicken = 0.013 TLU; 1 cow = 1 TLU; 1 Ox = 1 TLU (Storck et al., 1991)
Household’s knowledge about exclosures	
Number of extension visits	Number of extension visits made by the natural resource management development agent in 2014
Household’s training in exclosure management	Dummy variable with code 1 if household head or any other members had participated in exclosure management programs, otherwise code 0
Ecological conditions of exclosures	
Agroecological zone ^a	Categorical variables with three levels; 1 = lowland, 2 = intermediate, 3 = highland
Age of exclosure ^a	Categorical variables with three levels; 1 = new, 2 = intermediate-age, 3 = old
Geographical attributes	
Distance between household’s residence and the exclosure	Distance between household’s residence and exclosure in km
Distance between household’s residence and the district market	Distance between household’s residence and the district market in km
Number of households per ha of exclosures	The number of households with access rights to exclosures divided by the area of exclosure (HH: ha ratio)

^a Categorical variables with k levels were transferred into k-1 variables by using dummy coding method (Stockburger, 2016).

assigned duty (households involved in more than one duty).

2.1.2. Household' socio-economic profile

The literature shows an interrelationship between households' socio-economic profile and their perceptions and attitudes. However, the impacts of the socio-economic variables on local communities' perceptions and attitudes have been deemed ambiguous (Allendorf et al., 2006; Baral and Heinen, 2007; Kaltenborn et al., 2006; Kideghesho et al., 2007; Shibia, 2010; Tessema et al., 2010; Tomićević et al., 2010; Vodouhê et al., 2010; Xu et al., 2006). For example, the impact of education and gender on local perceptions and attitudes seems to be site-specific and inconsistent. While some scholars have reported that education has a strong impact on local attitudes (e.g., Allendorf et al., 2006; Rahman et al., 2017; Shibia, 2010; Xu et al., 2006), others have not found a correlation between education and local perceptions and attitudes (Baral and Heinen, 2007). Some studies have revealed that gender is a predictor of attitude, as women are more likely to have negative attitudes (Allendorf et al., 2006; Tomićević et al., 2010; Xu et al., 2006), whereas others have revealed that women are more concerned about conservation than are men (Ray et al., 2017; Kaeser and Willcox, 2018).

Social exchange theory assumes that power in social exchanges lies with those who possess more resources than do others. In the Tigray Region, a household's socio-economic profile indicates the resources possessed by the household and that influence its ability to take advantage of exclosures. The ability to take advantage of exclosures has impacts on household heads' evaluation of benefits and costs associated with exclosures. For example, households with comparatively large numbers of laborers have better possibilities to collect grass than those with smaller numbers of laborers or none. Consequently, they are more likely to perceive exclosures as having positive economic impacts. In our analysis, the variables describing a household's socio-economic profile were "gender of the household head," "log of age of the household head," "Average education of the household," "number of laborers in household" "household's cropland area," "household's herd size," "household's harvest status," and "household's level of duty."

2.1.3. Household's knowledge about exclosures

Some studies have shown that knowledge affects behavior (Zelezny, 1999), and perceptions and attitudes (Aipanjuguly et al., 2003; Chuang and Yen, 2017; Htun et al., 2012; Xu et al., 2006). Furthermore, Aipanjuguly et al. (2003) argue that households with more knowledge of protected areas will have positive attitudes, while social exclusion and lack of knowledge will lead to negative attitudes towards protected areas (Paraskevopoulos et al., 2003). Based on social exchange theory, households with comparatively more and accurate knowledge about an exchange can better estimate the costs and benefits associated with it. In the Tigray Region, local communities gain knowledge about their adjacent exclosures through either participating in training activities or interacting with development agents. We therefore used two variables as proxy for household's knowledge about exclosures: "household's training in exclosure management" and "number of extension visits (number of visits made by the natural resource management development agent in 2014)." Also the state of other variables, such as "gender of the household head," "Number of laborers in household," and geographical attributes, could have an impact on results relating to household's knowledge (Gilani et al., 2017; Xu et al., 2006).

2.1.4. Ecological conditions of exclosures

We assumed that if ecological conditions improve in the Tigray Region, local communities are more likely to perceive the ecological and economic impacts of exclosures as beneficial. Consequently, they might have positive attitudes towards their adjacent exclosures. In our analysis, we used two categorical variables to represent ecological conditions: "agroecological zone" and "age of exclosure." The agroecological zones in the Tigray Region consist of three classes according

to altitude: lowland exclosures located less than 1500 m a.s.l.; intermediate exclosures located 1500–2300 m a.s.l.; and highland exclosures located above 2300 m a.s.l.¹ Since exclosures located at higher altitude receive more precipitation, they are considered more productive in terms of vegetation. Consequently, households living adjacent to highland exclosures may perceive ecological and economic improvements due to the establishment of exclosures. The exclosures can be divided into three classes according to the number of years since they were established (age of exclosure = n): new exclosures (n ≤ 10 years), intermediate-age exclosures (10 < n ≤ 15 years), and old exclosures (n > 15 years). There is a positive correlation between the age of exclosures and the exclosures' vegetation cover and density (Yaynesht et al., 2009). However, the biomass of grass and other herbaceous species decreases with the increasing age of the exclosures, since the canopy of trees and shrubs becomes denser (Birhane et al., 2017).

2.1.5. Geographical attributes

Jurowski and Gursoy (2004) report that geographical attributes such as distance have significant effects on how individuals evaluate the costs and benefits of an exchange. Consequently, perceptions and attitudes are likely to differ among people living in different geographical situations (Gilani et al., 2017; MacKenzie et al., 2017; Muhamad et al., 2014). For example, local communities living relatively closer to protected areas tend to perceive that there are many ecosystem services (Sodhi et al., 2010), and consequently have positive attitudes towards their protected surroundings (Rahman et al., 2017). At the same time, local communities living closer to protected areas and farther from markets are more dependent on natural resources for their livelihoods (e.g., Mamo et al., 2007; Soltani et al., 2012), and it has been found that they feel more strongly that forests are essential for their livelihoods (Gilani et al., 2017). Household economic dependence has emerged as a significant factor influencing perceptions and attitudes (Kuvan and Akan, 2005). Furthermore, the size of the protected area and the number of people with access rights could influence perceptions and attitudes (Allendorf, 2007). If an exclosure is small and many households have access to it, each household's share of outputs from the exclosure will be small. This might cause household heads to perceive that there are fewer ecosystem services, and consequently develop negative attitudes towards exclosures. We used three variables to represent geographical attributes, namely "distance between household's residence and the exclosure," "distance between household's residence and the district market," and "number of households per ha of exclosures."

2.1.6. Household heads' perceptions of exclosures

Previous studies have indicated that people's perceptions of protected areas play an important role in shaping their attitudes towards protected areas (Allendorf et al., 2006; Chuang and Yen, 2017; Htun et al., 2012; Infield and Namara, 2001; McClanahan et al., 2005), and their participation in collective action and the management of protected areas (e.g., Sirivongs and Tsuchiya, 2012; Sullivan et al., 2017).

2.2. Study sites

Nine exclosures in the Tigray Region in northern Ethiopia were selected for analysis. The exclosures selected for study (new, intermediate-age, and old exclosures) are located in five districts, and

¹ Unpublished document written by Department of Land Resource Management and Environmental Protection, Mekelle University, Mekelle, Ethiopia in 2014 titled "Summary report on reconnaissance survey to select and study the exclosures in Tigray," prepared for a project titled "Steps towards Sustainable Forest Management with the Local Communities in Tigray, Northern Ethiopia." The Project was funded through a research grant from the Norwegian Agency for Development Cooperation (NORAD).

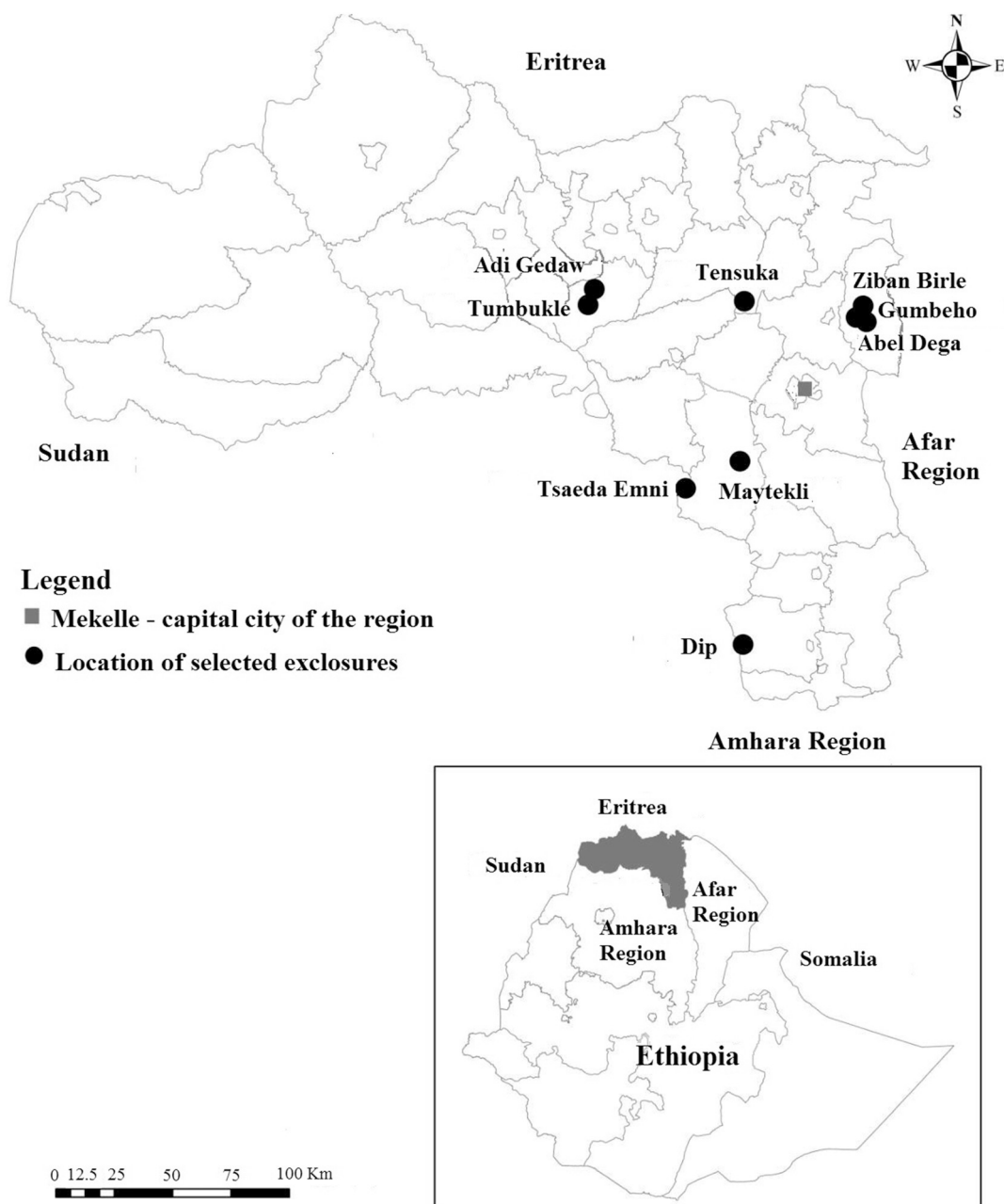


Fig. 2. Location of Tigray Region in Ethiopia and the studied exclosures in the Tigray Region.

Table 2

List of selected exclosures.

No.	Name of exclosure	Age	Agro-ecological zone	Number of households		Distance to Mekelle (km)	Administrative level		Area (ha)
				Population	Sample size		Village	District	
1	Ziban Brile	8	H	55	15	75	Micheal Emba	Atsbi	220
2	Maytekli	15	H	104	27	58	Maytekli	Samre	111
3	Gumbeho	20	H	216	58	75	Kaleamin	Atsbi	350
4	Tumbukle	10	I	295	79	285	Seka-Kisadmomona	Naeder Adet	177
5	Adi Gedaw	15	I	193	52	285	Debre Genet	Naeder Adet	234
6	Abel Dega	20	I	328	88	75	Hayelom	Atsbi	80
7	Tensuka	9	L	52	14	104	Koraro	Hawzen	168
8	Tsaeda Emni	15	L	201	54	58	Nebar Hadnet	Samre	210
9	Dip	20	L	219	59	150	Zata	Ofla	1254
	Sum			1663	446				2804

Notes: Age = years since establishment; Agro-ecological zones: H = highland, I = intermediate zone, L = lowland.

adjacent to nine villages in three agroecological zones (Fig. 2). The main characteristics of the selected exclosures are listed in Table 2. New and intermediate-age exclosures are dominated by grass and bush species, whereas in old exclosures different tree species dominate the vegetation, such as *Acacia polyacantha*, *Acacia asak*, *Acacia etbaica*, and *Eucalyptus* spp. The selected exclosures have been established on degraded grazing lands, where livestock were once taken to graze and villagers used to collect firewood. Only Adi Gedaw exclosure was established on cultivated land.

The main economic activity in the nine villages adjacent to the selected exclosures is a combination of crop cultivation and livestock husbandry. Additionally, there are a few other income sources such as remittances, handicrafts, and petty trade. Bylaws are devised to govern and manage the villages' resources, and according to the bylaws, grazing, firewood collection and agriculture are forbidden in the exclosures (Aerts et al., 2009; Mekuria et al., 2007), but households with access right are permitted to collect grass and fruits. The regulations defining the timing of harvesting and amount of produce gathered vary from exclosure to exclosure. The Tigray Bureau of Agriculture and Rural Development hires guards to protect the exclosures. However, illegal and clandestine harvesting still takes place (Babulo et al., 2009).

2.3. Data collection

The data were collected through a household survey, for which a household questionnaire and structured interviews were the main tools. The questionnaire was modified following the information obtained through a pilot survey and field visits. The list of households living adjacent to the nine exclosures and with access rights to them was obtained from the Tigray Bureau of Agricultural and Rural Development's village offices. Based on Cochran's formula, the ideal sample size was calculated as 425 households. However, the sample size was increased to 450 in case a few of the questionnaires were incompletely filled. The households were chosen by stratified random sampling (Cochran, 1977), whereby the nine villages formed the strata. The sample size in each village was calculated by proportional sampling. Four of the completed questionnaires were excluded due to incomplete information and thus the final sample size was 446 households.

The household questionnaire consisted of two parts. The first part provided information on household composition and education, livestock and cropland ownership, knowledge regarding the local exclosure, participation in training programs, quantity of different outputs collected from the exclosures, household's protection duties, and household's interactions with development agent. The second part of questionnaire contained 17 perception statements and 3 questions to capture household heads' attitudes towards the exclosures (listed in Table 3). Each household head was asked to rate his or her perceptions based on a five-point Likert scale, on which 1 indicated "strongly disagree" and 5 indicated "strongly agree." Additionally, household heads were asked whether they had agreed with the idea of exclosures prior to their establishment, whether they felt happy about the existing exclosures, and whether they would support any future expansion of exclosures. Additionally, household heads' explanations for their responses were recorded, together with qualitative field observations. Information on the exclosures such as their size, age and agroecological zone was obtained from secondary data (see Footnote 1). The distances between the household's settlement and both the local exclosure and the district markets were recorded using GPS during the household survey.

2.4. Data analysis

We used quantitative methods, namely factor analysis, multiple linear regression and binary logit regression, to analyze local household heads' perceptions of and attitudes towards exclosures.

2.4.1. Factor analysis

Factor analysis was used to reduce 17 perception statements to 4 meaningful components. This was done by using the principal component extraction method and varimax rotation. The factors were structured on the basis of the proportion of variance explained, number of eigenvalues greater than one, and the number and the difference between cross-loading items. Perception statements (items) were reduced to factors according to their loading (i.e., the correlation between the item and the factor). Only items with loading greater than 0.40 were selected. If the difference between loadings for cross-loading items was less than 0.2, the item was included in the factor that made most sense conceptually (Diiorio, 2006).

2.4.2. Multiple linear regression

After factor analysis, a multiple linear regression model using the extracted factors as dependent variables was employed to identify factors that influenced the household heads' perceptions of selected exclosures. See Table 1 for the explanatory variables and their definitions.

2.4.3. Binary logit regression

To determine factors that influenced the household heads' attitudes towards exclosures, a binary measure was used in a binary logit model specification. The household heads were asked whether they felt happy with the existing exclosures (code 1 if the answer was "Yes," otherwise code 0). Similarly, the household heads were asked whether they would support the expansion of exclosures (code 1 associated with a "Yes" response, otherwise code 0). The explanatory variables included in the binary logit regression are listed in Table 1.

3. Results and discussion

3.1. Local household heads' perceptions of exclosures

The results of the factor analysis are shown in Table 3. The first principal component factor had high positive significant loadings on the following statements: "household income has increased," "yield of honey production has increased," "number of local breed animals has decreased," "number of exotic breed animals has increased," "crop productivity has increased," "number of conflicts over natural resource use has decreased," and "number of water springs has increased." The second factor had high positive significant loadings on "households have equal access to outputs from exclosures" and "households have equal access to information about exclosures," while the third factor had high positive significant loadings on the following statements: "bylaws are practiced to share the outputs from exclosures," "local communities are responsible for revising bylaws," "local community awareness of afforestation has increased," and "monitoring and evaluation of activities are undertaken." The fourth factor had high positive significant loadings on "number of trees in the exclosure has increased," "flooding has decreased," and "the microclimate of the area has improved." The four factors were named according to their associated statements. Thus, the first and second factors were respectively named "economic improvement" and "equal access," and the third and fourth factors were named "local involvement" and "ecological improvement." Only the item "more grass is available for livestock husbandry" cross-loaded with two factors—"economic improvement" and "equal access"—and the difference between the loadings (0.53–0.42) was less than 0.2. The item was linked to the quantity of grass rather than to the distribution of access to collect grass, and therefore it was conceptually more relevant to include "more grass is available for livestock husbandry" under "economic improvement." The mean of the Likert-scale values assigned to perception statements ranged from 3.00 to 4.63 (Table 3). Of the 17 statements, 3 statements under "ecological improvement," 4 statements under "local involvement," and 2 statements under "equal access" had mean values ranging from 4.13 to 4.63,

Table 3
Extracted factors and correlation with original statements used in factor analysis.

Perception statements	Factor 1	Factor 2	Factor 3	Factor 4	Mean (SD)
Household income has increased	0.74	0.28	0.11	0.24	3.0 (1.1)
More grass is available for livestock husbandry	0.42	0.53	0.21	0.19	3.8 (0.9)
Yield of honey production has increased	0.58	0.16	0.22	0.22	3.4 (0.9)
Number of local breed animals has decreased	0.66	-0.002	0.05	0.04	3.8 (0.8)
Number of exotic breed animals has increased	0.80	0.02	-0.04	-0.11	3.4 (1.1)
Crop productivity has increased	0.70	0.16	0.01	0.26	3.6 (1.0)
Bylaws are practiced to share the outputs from exclosures	-0.18	0.41	0.58	0.15	4.1 (0.8)
Households have equal access to outputs from exclosures	0.06	0.85	0.23	0.01	3.4 (1.0)
Households have equal access to information about exclosures	0.01	0.86	0.22	-0.04	4.2 (0.9)
Local communities are responsible for revising the bylaws	0.30	0.25	0.53	-0.07	4.3 (0.9)
Number of conflicts over natural resource use has decreased	0.54	-0.02	0.25	0.01	4.3 (0.7)
Local community awareness of afforestation has increased	-0.02	0.07	0.80	0.13	4.1 (0.7)
Monitoring and evaluation activities are undertaken	0.17	0.24	0.76	-0.09	4.3 (0.6)
Number of trees in the exclosure has increased	0.01	0.13	-0.13	0.82	4.2 (0.7)
Flooding has decreased	0.13	-0.15	0.25	0.70	4.5 (0.6)
Number of water springs has increased	0.79	-0.16	-0.12	-0.06	4.6 (0.6)
The microclimate of the area has improved	0.52	0.15	-0.03	0.51	4.3 (0.7)
Eigen value	4.85	2.75	1.45	1.09	
Percentage of total variance explained	28.53	16.21	8.57	6.41	
Cronbach's alpha (α)	0.84	0.85	0.711	0.57	

Meyer-Olkin Measure of Sampling Adequacy = 0.84;

Bartlett's Test of Sphericity and approximate Chi-square = 2586.38; p-value = 0.000; SD = standard deviation.

while the 8 statements under “economic improvement” had mean values between 3.00 and 4.07 (Table 3).

The results of the factor analysis revealed that local household heads' perceptions of exclosures in the Tigray Region could be grouped under social, economic and ecological dimensions. Factor analysis has been the most commonly used method to reduce the number of perception statements and examine their structure of interrelations (e.g., Badola et al., 2012; Bessie et al., 2014; Dolisca et al., 2007; Kukrety et al., 2013; Zeweld et al., 2017). However, other statistical methods, such as multidimensional scaling (MDS), have been also applied to other research to detect underlying dimensions of opinions, explain similarities and dissimilarities among perceptions, and estimate the level of sustainability of each dimension based on respondents' opinions (Sukwika et al., 2016).

Fig. 3A shows the mean percentages of local household heads who strongly agreed or agreed, and disagreed or strongly disagreed with each factor. The responses under “strongly disagree” and “disagree” have been combined and presented together, and the responses under “agree” and “strongly agree” have been treated similarly. On average, 97%, 93% and 89% of the sample household heads either agreed or strongly agreed with the statements under the respective headings “ecological improvement,” “local involvement,” and “equal access.” The fact that the respondents expressed the highest level of agreement with the statements under “ecological improvement” can be attributable to the primary purpose of the establishment of exclosures, which was to enhance the ecological conditions of degraded lands (Gebremedhin et al., 2003), rather than to generate any economic gains. A study conducted by Schusser et al. (2015) revealed that powerful actors such as forest administrations and non-governmental organizations (NGOs) cared more about the ecological outcomes of community forest management than they did about the people who were dependent on those resources. Similarly, Nurrochmat et al. (2017) found that the Meru Betiri National Park Office prioritized ecosystem preservation, while extraction and income generating activities were more important for other actors involved in management of the park. Other scholars have reported that local communities have perceived exclosures as effective in restoring degraded soils and vegetation (Birhane et al., 2017; Mengistu et al., 2005; Mekuria, 2013). However, on our study, the mean percentage of the sample household heads who strongly agreed or agreed with the statements under “economic improvement” was 58%. Similar results have been reported earlier,

namely that local communities have expressed their concerns about the economic impacts of exclosures (Mekuria, 2013), and perceived exclosures more as environmental rehabilitation interventions than as beneficial measures in terms of economy (Birhane et al., 2017). Sukwika et al. (2016) found similar results in a different context, as the ecological dimension of privately managed forests in Indonesia was found moderately sustainable, while the economic dimension was less sustainable. Scholars have previously found that the sustainable management of any protected areas should comprise both protection and income generating activities (Nurrochmat et al., 2017; Kustanti et al., 2014). It is worth mentioning that we did not analyze the positive outcomes of exclosures, only local people's perceptions of such achievements. Therefore, our results should not be interpreted as meaning that exclosures are not associated with positive economic outcomes, since more than half of the respondents agreed that exclosures had contributed to economic improvement. Moreover, other studies have shown that exclosures generate economic benefits (Balana et al., 2012).

Gebregziabher et al. (2017) found that the distribution of values of outputs from some exclosures was skewed, and that the poorest quartile of households had almost no benefits from the exclosures. However, our findings revealed that almost 90% of respondents perceived access to information about exclosures and the outputs from exclosures as equal (Fig. 3A). It has been observed repeatedly that the perception of equity is not directly correlated with equal distribution of income (Cruces et al., 2013), wealth, power, or opportunities (Wegener, 1990). Furthermore, cultural differences in the perception of equity have long been observed (Chhokar et al., 2001). The discrepancy between our findings and the results reported by Gebregziabher et al. (2017) can be explained by the fact that equal access does not prevent unequal distribution of outputs. Individuals may have equal access to exclosures, but their harvest levels and distribution of outputs may depend on other factors, such as available labor. In addition, it is probable that poor people in the Tigray Region are so used to having little that they do not expect anything from exclosures. Generally, people cannot tolerate perceiving their own situation as unfair over long periods, and therefore rationalize and find a reason to accept skewed distributions (Kay et al., 2007; Olson and Schober, 1993). This phenomenon was not investigated thoroughly during our fieldwork, but it may be an interesting topic for future research.

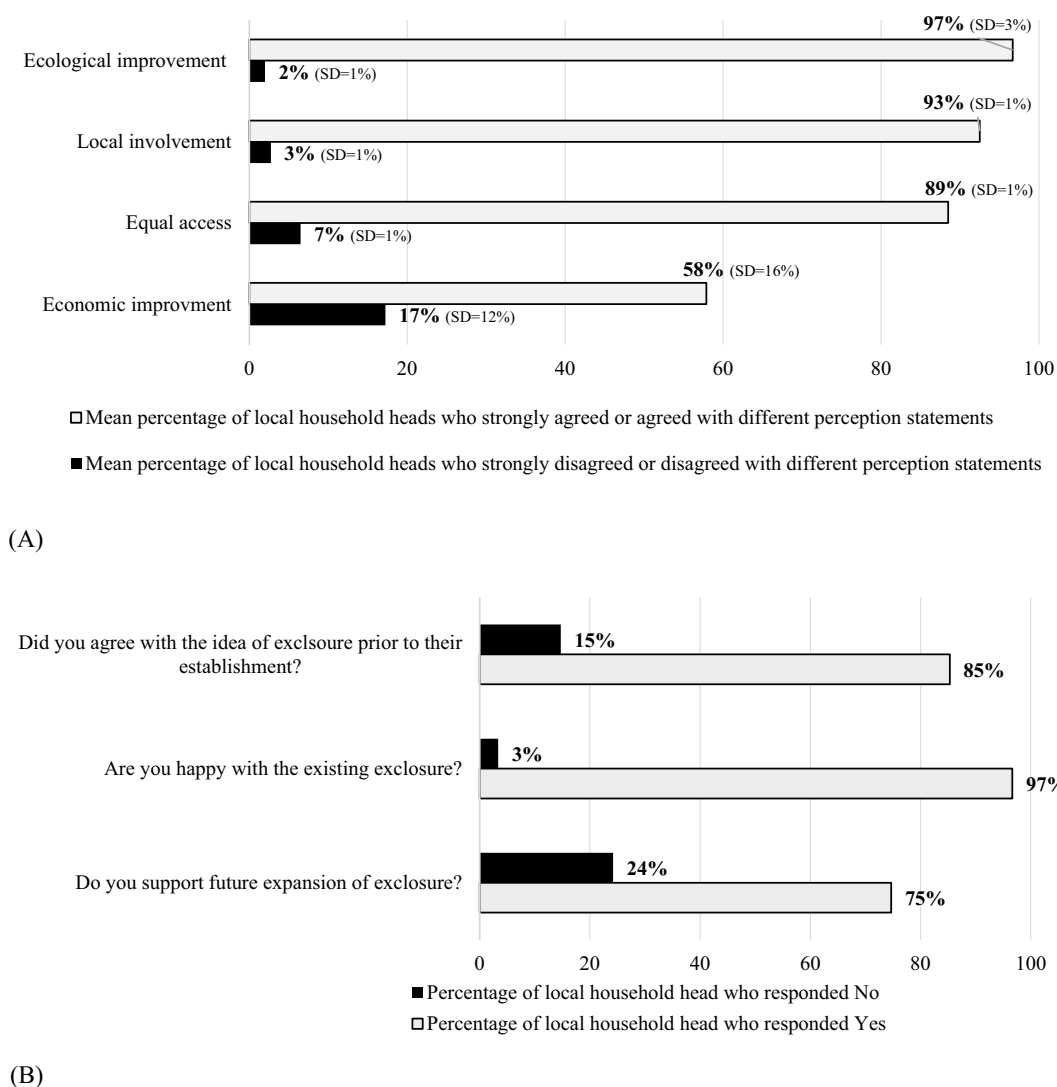


Fig. 3. Households' perceptions of (A) and attitudes towards selected exclosures (B)
SD= standard deviation.
Mean percentage of local household head responded "not sure" is not illustrated in Fig. A.

3.2. Local household heads' attitudes towards existing exclosures and further expansion of exclosures

A total of 377 of sampled household heads (85%) agreed with the idea of exclosures prior to their establishment, 97% (431 households) were happy with existing exclosures, and 76% (338 households) said they would support the expansion of exclosures (Fig. 3B). The respondents linked their positive attitudes towards exclosures prior to their actual establishment to two reasons. First, the affected lands were marginal and degraded, to the extent that they did not contribute much to local people's livelihoods, and therefore, local communities could easily accept them becoming exclosures. Other scholars have reported that local people support conservation efforts as long as their livelihoods are ensured and their interests are not threatened (Akyol et al., 2018; Badola et al., 2012; Hussain et al., 2016; Kideghesho et al., 2007). The second reason was that, as consequences of establishment of exclosures, local communities expected to receive economic rewards, such as employment, grass collection, and beekeeping, as well as environmental rewards, such as reduced erosion. Respondents with positive attitudes toward existing exclosure described that establishment of exclosures had reduced soil erosion, and consequently croplands located near to the exclosures were more productive. They also

mentioned access to collect grass as a reason for their positive attitudes towards existing exclosures.

However, our results showed some resistance among respondents towards the future expansion of exclosures, as the number of household heads supporting such expansion was lower than the number of household heads with positive attitudes towards the existing exclosures (Fig. 3B). Those who expressed negative attitudes towards the expansion of exclosure linked their resistance to the impact of exclosures on livestock husbandry and the availability of communal grazing lands and firewood. In the Tigray Region, traditional livestock husbandry is based on a continuous grazing system managed by herders. It is not permitted to graze livestock within the exclosures, but animals can graze freely on grazing lands elsewhere. The main output from the case exclosures is grass, which should be cut and transported to feed livestock (Gebregziabher et al., 2017; Tadesse and Teketay, 2017). According to the afore-cited authors, since cutting and transporting grass is more labor-intensive than is tending to grazing animals, local farmers are concerned that the expansion of exclosures would minimize the grazing lands and make their engagement in livestock husbandry more difficult or almost impossible. In some areas, there was not enough land available for the establishment of exclosures. Moreover, local communities used firewood to meet their energy needs and the expansion of

Table 4
Determinants of local perceptions of enclosures.

Variables	Economic improvement	Equal access	Local involvement	Ecological improvement
	Coef.(SE)	Coef. (SE)	Coef. (SE)	Coef. (SE)
Constant	-0.43 (0.81)	-1.13 (0.76)	0.42 (0.87)	-0.82 (0.86)
Household's harvest status	0.41 (0.11)***	1.04 (0.10)***	0.42 (0.12)***	-0.06 (0.12)
Low assigned duty	-0.25 (0.23)	0.02 (0.22)	0.54 (0.25)**	-0.35 (0.24)
High assigned duty	-0.02 (0.13)	0.02 (0.12)	0.31 (0.14)**	0.21 (0.14)
Gender of the household head	0.06 (0.12)	-0.27 (0.12)**	0.00 (0.12)	0.22 (0.12)*
Log of age of the household head	-0.04 (0.38)	-0.22 (0.35)	-0.19 (0.40)	-0.49 (0.40)
Average education of the household	0.05 (0.03)	0.02 (0.03)	-0.01 (0.03)	0.03 (0.03)
Number of laborers in household	0.01 (0.05)	0.08 (0.04)*	0.01 (0.05)	-0.01 (0.05)
Household's cropland area	-0.03 (0.09)	0.09 (0.08)	-0.06 (0.09)	-0.03 (0.09)
Household's herd size	0.05 (0.02)**	-0.03 (0.02)	0.02 (0.02)	-0.02 (0.02)
Number of extension visits	-0.12 (0.03)***	0.07 (0.03)**	-0.04 (0.03)	0.07 (0.03)**
Household's training in enclosure management	0.82 (0.12)***	-0.15 (0.11)	0.16 (0.13)	0.15 (0.12)
Intermediate zone	0.20 (0.34)	0.20 (0.32)	-0.58 (0.37)	1.14 (0.37)***
Highland	0.14 (0.36)	0.32 (0.34)	-0.58 (0.39)	1.25 (0.39)***
Intermediate – age enclosure	-0.04 (0.16)	-0.12 (0.15)	-0.39 (0.17)**	-0.18 (0.17)
Old enclosure	0.06 (0.16)	-0.36 (0.15)**	-0.08 (0.17)	0.07 (0.17)
Distance between household's residence and the enclosure	-0.18 (.07)***	0.05 (0.06)	0.11 (0.07)	0.01 (0.07)
Distance between household's residence and the district market	0.00 (0.02)	0.03 (0.02)	-0.03 (0.02)	0.04 (0.02)*
Number of households per ha of enclosures	0.05 (0.13)	0.12 (0.12)	0.07 (0.14)	0.12 (0.14)
N (observation number)	446	446	446	446
R ²	0.257	0.340	0.121	0.159
Adjusted R ²	0.223	0.310	0.081	0.121
F statistic	7.648***	11.383***	3.047***	4.169***

Notes: ***Significant at 1%, ** Significant at 5%, * Significant at 10%.

enclosures would limit available sources of firewood.

3.3. Determinants of local household heads' perceptions of enclosures and attitudes towards existing enclosures and the expansion of enclosures

The variable “household's harvest status” had a positive and significant influence on household heads' perception of “economic improvement,” “equal access,” and “local involvement” (Table 4). The variable measures whether ecosystem services (especially direct ones) provided by enclosures (Mekuria, 2013) are recognized by local communities as benefits. Thus, it was not surprising to observe the positive association between the variable and perception of “economic improvement.” Our results are supported by other studies conducted in Ethiopia (e.g., Birhane et al., 2017; Mengistu et al., 2005). At the same time, the variable had a positive and significant association with “attitude towards enclosures” (Table 5). The positive connection between obtaining benefits from protected areas and favorable attitudes towards protection is supported by the social exchange theory, and has been confirmed empirically by studies conducted in many parts of the world (Allendorf, 2007; Allendorf et al., 2006; Baral and Heinen, 2007; Dewu and Røskaft, 2018; Htun et al., 2012; Infield and Namara, 2001; Kuvan and Akan, 2005; Vodouhê et al., 2010; Walpole and Goodwin, 2001; Xu et al., 2006). In contrast to social exchange theory, a negative association between the variable “household's harvest status” and “attitude towards expansion of enclosures” was observed. This can be explained by the fact that the local people preferred grazing lands to enclosures. They were concerned that the expansion of enclosures would lead to the replacement of grass by trees, and consequently there would be a shortage of fodder (Birhane et al., 2017). Furthermore, livestock husbandry based on cutting and transporting grass is more labor-intensive than livestock husbandry based on grazing and managed by herders.

Additionally, the regression results revealed that compared with “no assigned duty,” both “low assigned duty,” and “high assigned duty” had a positive and significant influence on household heads' perception of “local involvement” (Table 4). By contrast, compared with “no assigned duty,” both “low assigned duty” and “high assigned duty” were associated with negative attitudes towards enclosures (Table 4). As suggested by social exchange theory (Ap, 1990), the relationship between

Table 5
Determinants of local attitudes towards enclosures and expansion of enclosures.

Variables	Attitude towards enclosures	Attitude towards expansion of enclosures
	Coef. (SE)	Coef. (SE)
Constant	12.78 (14.95)	-3.05 (2.54)
Household's harvest status	5.50 (1.90)***	-0.86 (0.38)**
Low assigned duty	-7.32 (2.92)**	-0.92 (0.65)
High assigned duty	-3.12 (1.55)**	-0.21 (0.40)
Gender of the household head	1.67 (1.47)	0.10 (0.34)
Log of age of the household head	-8.69 (5.78)	-1.05 (1.09)
Average education of the household	0.04 (0.29)	-0.03 (0.09)
Number of laborers in household	-0.16 (0.55)	0.18 (0.14)
Household's cropland area	-1.36 (1.15)	0.24 (0.26)
Household's herd size	-0.43 (0.29)	0.09 (0.07)
Number of extension visits	0.93 (0.63)	-0.25 (0.08)***
Household's training in enclosure management	14.25 (3082.98)	0.52 (0.42)
Intermediate zone	6.02 (9.09)	5.37 (1.46)***
Highland	1.97 (7.12)	3.64 (1.25)***
Intermediate-age enclosure	1.55 (5.23)	-0.06 (0.55)
Old enclosure	-0.15 (6.16)	-0.60 (0.60)
Economic improvement	2.88 (1.09)***	0.55 (0.16)***
Equal access	0.00 (0.51)	0.27 (0.16)*
Local involvement	-1.61 (0.71)**	0.07 (0.14)
Ecological improvement	0.08 (0.51)	-0.19 (0.14)
Distance between household's residence and the enclosure	0.06 (1.07)	-0.25 (0.22)
Distance between household's residence and the district market	0.40 (0.38)	0.22 (0.06)***
Number of households per ha of enclosures	2.24 (4.31)	0.94 (0.47)**
Percentage correctly predicted	98.1	77.2
-2 Log likelihood	43.675	380.588
Model Chi-square	65.132	75.508
P-value	0.000	0.000
Sample size	417	417

Notes: *** Significant at 1%, ** Significant at 5%, * Significant at 10%.

benefits obtained from enclosures and the associated costs is the underlying factor that shapes local people's attitudes. If the costs

associated with the establishment of exclosures (in our case, the assigned duties and the loss of grazing land) can be offset by the expected gain, positive attitudes towards the exclosures can be maintained. The balance between costs and benefits is critical to maintain local institutions (Ostrom, 2005), and to avoid unfair distribution of outputs from exclosures (Gebregziabher et al., 2017). The authors of a number of studies have concluded that costs associated with conservation and protection have negative effects on local communities' attitudes (e.g., Dewu and Røskaft, 2018; Walpole and Goodwin, 2001; Xu et al., 2006).

Furthermore, variable "gender of the household head" had negative and significant impact on household heads' perception of "equal access" and a positive and significant influence on household heads' perception of "ecological improvement" (Table 4). Based on our observations during fieldwork we linked the positive association between "gender of the household head" and household heads' perception of "equal access" to women's previous experiences of access to information and outputs. Female heads of households in the villages felt that they had been discriminated against in many situations. The current bylaws of exclosures provide local people with equal access to adjacent exclosures, regardless of their gender. Accordingly, the female respondents tended to perceive the management of exclosures as more equitable and fair than did their male counterparts. However, compared with the women, the men invested more time and effort to protect the exclosures. As also found by Gebregziabher et al. (2017), the level of villagers' efforts did not influence the share of outputs from exclosures. Thus, the men might have perceived the distribution of outputs from exclosures as unfair. The degree of impact that gender has on various perceptions of protected areas varies (Allendorf and Yang, 2017; Dolisca et al., 2007; Muhamad et al., 2014). Regarding the impacts of gender on attitudes towards exclosures, our results did not reveal any patterns (Table 5), for two reasons: the bylaws do not consider the gender of household's head, and the men and women perceived exclosures differently (Table 4). Male-headed households perceived exclosures in terms of ecological improvements, while female-headed households perceived them as affording equal access to resources. Furthermore, the cost of establishing exclosures affected both men and women. For example, men could be arrested if they were found grazing or watering their livestock within the exclosures, and the women could be fined upon entering the exclosures to collect firewood. Our results are similar to those of from previous studies that did not reveal any gendered impacts on attitudes (Baral and Heinen, 2007; Kideghesho et al., 2007; Shibia, 2010). However, some scholars have found that, compared with women, men are more likely to have a positive attitude towards conservation issues and protected areas (e.g., Allendorf et al., 2006; Badola et al., 2012; Xu et al., 2006), while others have found that women had positive attitudes towards conservation issues (Ray et al., 2017; Kaeser and Willcox, 2018).

Our results revealed that, compared with households with relative small number of laborers, households with larger numbers of laborers (households with more of family members in the age range of 15–64 years) perceived the distribution of outputs from exclosures as more equal (i.e., we found a positive and significant association between "Number of laborers in household" and household heads' perception of "equal access"). Similarly, households with larger numbers of laborers were more likely to perceive access to information about exclosures as equal (Table 4). This can be attributed to the fact that households with more family members in the age range 15–64 years tend to have better opportunities to interact with others and acquire information (Xu et al., 2006). Households with more available laborers than other households also had more opportunities to collect outputs from exclosures.

Moreover, in our study, households with comparatively more livestock perceived that the establishment of exclosures had improved their economic conditions (i.e., there was a positive and significant association between a "household's herd size" and a household's perception of "economic improvement"). This finding should not be surprising because people with comparatively more cattle are more likely to collect

grass from exclosures. The finding is also supported by social exchange theory, as the benefits of exclosures were mainly enjoyed by those who had more resources and were in better position to harvest from the exclosures. Muhamad et al. (2014) and Poppenborg and Koellner (2013) have reported that people with large herd sizes are more likely to have positive attitudes towards ecosystem services. However, if the establishment of protected areas limits people's access to grazing lands and fodder, or leads to increases in the livestock losses due to increased wildlife populations, it will definitely create negative attitudes among those with comparatively larger herds (Allendorf et al., 2006; Kideghesho et al., 2007; Tessema et al., 2010; Vodouhê et al., 2010).

The variable "number of extension visits" had a negative and significant impact on the household heads' perception of "economic improvement," while the variable "household's training in exclosure management" had a positive and significant influence on the aforementioned perception. In addition, the variable "number of extension visits" had a positive and significant influence on household heads' perceptions of "equal access" and "ecological improvement," and was associated with negative attitudes towards the expansion of exclosures. Previous studies have demonstrated the association between knowledge of protected areas and positive attitudes towards conservation (e.g., Aipanjiguly et al., 2003; Htun et al., 2012; Moges and Taye, 2017; Tadesse and Teketay, 2017; Tesfaye et al., 2012). However, our results regarding the impact of knowledge on attitudes are somewhat different (Table 5). Development agents are employed by the Tigray Bureau of Agriculture and Rural Development to provide local communities with information about protection and conservation activities. This may explain why households with that interacted more with development agents than did other households expressed higher levels of agreement with statements under "ecological improvement," while they did not perceive much economic improvement (Table 4). Moreover, they were less likely to have positive attitudes towards the expansion of exclosures (Table 5). This finding indicates that local communities that do not perceive any economic advantages would not support the expansion of exclosures.

Furthermore, compared with "lowland," both "intermediate zone," and "highland" had a positive and significant influence on household heads' perception of "ecological improvement" and their attitudes towards the expansion of exclosures (Table 5). Compared with exclosures in lowland, exclosures located in highland or intermediate zones receive larger amounts of precipitation and are therefore more productive, which in turn may facilitate the rehabilitation of degraded lands. Consequently, households living adjacent to such exclosures were more likely to perceive ecological improvements (Table 4) and expressed favorable attitudes towards the expansion of exclosures (Table 5). However, compared with "new exclosure," "intermediate-age exclosure" had a negative and significant influence on household heads' perception of "local involvement," while compared with "new exclosure," the variable "old exclosure" had a negative and significant impact on their perception of "equal access." The longer the time since an exclosure has been established, the less degraded it will be (Yaynesht et al., 2009); hence, comparatively larger amounts of outputs from exclosures will be available. With time, the biomass of grass usually decreases, and trees and shrubs dominate the vegetation. Therefore, the most important output shifts from grass to firewood over time. Consequently, local communities living adjacent to older exclosures may perceive there are less supplies of grass from exclosures than those living adjacent to either intermediate-age or new exclosures, as reported by Birhane et al. (2017). Gebregziabher et al. (2017) found that the outputs from exclosures were more evenly distributed in old exclosures compared with either intermediate-age or new exclosures. Thus, it is surprising that, in our study, household heads living adjacent to old exclosures perceived access to information and outputs as unequal.

The variable "distance between household's residence and the exclosure" had a negative and significant impact on the household heads'

perception of “economic improvement.” However, the variables “distance between household’s residence and the district market” and “number of household’s per ha of exclosures” were associated with the positive attitudes towards expansion of exclosures. Geographical attributes such as distance between settlements and exclosures, distance between settlements and district markets, and the number of households per ha of exclosures influence resource accessibility. As described by economic theory, the distance between settlements and resource location is positively correlated with the opportunity cost of labor and the required time to collect outputs (e.g., Amacher et al., 1996; Robinson and Lokina, 2011); this reduces the probability of households collecting any outputs from protected areas (Gebregziabher et al., 2017; MacKenzie et al., 2017). Therefore, households living farther away from exclosures are less likely to perceive exclosures as contributing to their economic situation (Table 4). However, distances between a household’s residence and markets and cities can define remoteness. Apparently, those who perceived ecological improvements tended to live in villages that were more remote than were other villages (Table 4). Exclosures that are remote from markets probably are not exploited as much as the exclosures close to markets, and this may explain why the households living in remote villages more often perceived ecological improvements than did households living in less remote villages. However, at the time of the study, most outputs from exclosures in the Tigray Region were used for subsistence. Generally, households living in remote villages have limited access to job opportunities for income generation and rely more heavily on products from nearby resources (Mamo et al., 2007; Soltani et al., 2012). According to social exchange theory, economic dependence has positive impacts on attitudes (Kuvan and Akan, 2005; Rahman et al., 2017), and this may explain why we observed a positive association between “distance between household’s residence and the district market” and attitudes towards the expansion of exclosures (Table 5). Households with user rights in exclosures that were under higher pressure (i.e., due to more households per ha of exclosures) had a more positive attitude towards the expansion of exclosures (Table 5), since the existing exclosures did not meet their needs. However, if households living in more densely populated areas are faced with either shortages of land for expansion and/or cropland or shortages of firewood, they may develop negative attitudes towards protected areas (Htun et al., 2012).

Household heads’ perceptions of “economic improvement” had a positive and significant influence on the variable “attitude towards exclosure,” while household heads’ perception of “local involvement” was negatively associated with that variable. Household heads’ perceptions of “economic improvement” and “equal access” were associated with positive attitudes towards the expansion of exclosures, and this finding indicates that perceptions of economic improvement and equal access play key roles in attitudes towards exclosures, as reported by other scholars (e.g., Allendorf et al., 2006; McClanahan et al., 2005). Local communities’ perceptions of equal access strengthen their sense of ownership and consequently they are less motivated to engage in illegal activities (Birhane et al., 2017). Furthermore, the Tigray Bureau of Agriculture and Rural Development has been reported as playing a leading role in disseminating information about exclosures (Birhane et al., 2017), and the management of exclosures has been criticized for being a top-down process (Lemenih and Kassa, 2014; Segers et al., 2008, 2009). Regardless of the amount of effort invested by local communities, both central and local authorities make most decisions regarding exclosures, and local communities have only been consulted in the expectation that they will agree to participate in those decisions. This may explain the negative association between the respondents’ statements under “local involvement” and their attitudes towards existing exclosures. Furthermore, Schusser et al. (2015) found that powerful actors had the capacity to decide on the outcomes of community forestry by influencing other actors. Overall, our results show that local perceptions have far more influence on attitudes than variables describing socio-economic context. This may indicate that a number of

socio-economic variables have an indirect influence on attitudes through influencing perceptions. If so, this would support the findings made by Allendorf et al. (2006), who argue that much effort must be invested to influence local perceptions and improve local attitudes towards the surrounding protected areas.

As mentioned, we used social exchange theory to study local household heads’ perceptions of and attitudes towards their adjacent exclosures. According to Schwab et al. (2017), social exchange theory provides a better orientation than other theories, such as the theory of planned behavior, to analyze human interactions in relation to perceptions of and attitudes towards nature. By using social exchange theory, we assumed that humans would be in a reciprocal relationship with nature rather than being in a superior position (Schwab et al., 2017). The theory assumes that the trade-off between the benefits obtained from exclosures and the cost associated with their establishment and maintenance has impacts on both local perceptions and attitudes. Our findings have supported this assumption, since they revealed that those who harvested outputs from exclosures or had larger herds and more laborers than did other households perceived positive impacts of exclosures, and similarly those with positive perceptions of economic improvement had positive attitudes towards exclosures. Our respondents justified their perceptions of and attitudes towards exclosures in terms of their expectations of benefits and costs, which points to the suitability of social exchange theory for studies of perceptions and attitudes.

However, our study had a few shortcomings. First, our results indicated that the majority of local household heads agreed with the establishment of exclosures and had positive attitudes. This may raise a question regarding technocratic domination in the management process. Scholars have previously reported that local authorities tend to press local communities to agree with the establishment of exclosures in order to reach targets set by central government (Lemenih and Kassa, 2014; Segers et al., 2008, 2009). The governance of exclosures, the identification of powerful actors involved in the management process, and the analysis of their power and influence (Krott et al., 2014; Kustanti et al., 2014; Nurrochmat et al., 2017; Schusser et al., 2015) could thus be the focus of future studies.

The second limitation is that exclosures represent multistakeholder resources. We examined local household heads’ perceptions and attitudes regardless of their interests, power, and influence. A village community is not a homogenous unit, and a number of actors within a village will have differing and conflicting interests. At the same time, external actors such as the Tigray Bureau of Agriculture and Rural Development, NGOs, media, and research organizations are involved in the management of exclosures to various extents, and their interests and powers to influence the management of exclosures differ substantially. One suggestion for further research is the identification of political, social, economic, and environmental actors who influence the outcomes of exclosures, examination of their perceptions and attitudes, and analysis of their motives and interests (Etongo et al., 2018; Kijazi and Kant, 2011; Nurrochmat et al., 2017; Schusser et al., 2015).

As a third limitation, it may be questioned whether the respondents expressed their true perceptions and attitudes towards exclosures, whether their statements were true expressions of their intrinsic or “real” interests (Nurrochmat et al., 2017). It is possible that local respondents told us that they were satisfied with establishment of exclosures because they either knew or assumed this was what educated people wanted them to say. Therefore, in order to find what local people really think about exclosures, it may be necessary for researchers to observe what people do rather than asking about perceptions and attitudes (Manun’Ebo et al., 1997). We know that illegal activities such as grazing and firewood collection take place in exclosures, and this is an indication that some villagers are interested in short-term benefits rather than long-term environmental improvements. However, it would be an exaggeration to conclude that our findings are the results of false statements and not expressions of real interests. There must be a

limit to how freely a researcher can interpret what respondents really mean as opposed to what they actually state (Urama and Hodge, 2006).

A fourth limitation of our study concerns the fact that power is a central element in the process of any exchange (Nunkoo, 2016). Scholars have used power theories such as actor-centered power and power grid matrix to identify powerful actors involved in community forest management in different parts of the world (Krott et al., 2014; Kustanti et al., 2014; Nurrochmat et al., 2017; Schusser et al., 2015). Combining social exchange theory with power theories could therefore be an interesting path for future research to study perceptions and attitudes (Nunkoo, 2016). In that way, we might be able to build an integrative framework that would enable us to test empirically different actors' perceptions and attitudes in connection to their interests, power and influence.

As a fifth and final limitation, we studied only nine exclosures, and therefore this may raise some concerns regarding the generalization of our findings to the Tigray Region as a whole. A larger number of exclosures might have revealed more variations and provided better predictions of perceptions and attitudes. However, several factors (e.g., agroecological zones, and years since establishment) were considered when designing the study, and this stratified sampling might have ensured that the selected exclosures are representative of exclosures in the Tigray Region.

4. Conclusions

Although our study was conducted in the Tigray Region in Ethiopia, our findings have relevance beyond the villages we examined. There are four main findings from our study of local perceptions and attitudes in Tigray Region. *First*, the majority of local household heads perceived that the establishment of exclosures had positive ecological, social and economic impacts. However, they gave lower scores to the statements related to the economic advantages of exclosures. *Second*, the majority of household heads had positive attitudes towards existing exclosures and little resistance towards the expansion of exclosures. *Third*, local household heads' perceptions of exclosures were influenced by tangible benefits and costs associated with exclosures, household socio-economic profiles, household's knowledge about exclosures, ecological conditions of exclosures, and geographical attributes. *Fourth*, our results confirm that the respondents' perceptions of economic improvement and equal access played important roles in their attitudes towards exclosures.

Our findings have three policy implications. *First*, to improve local people's attitudes towards their adjacent exclosures, it is important to implement measures that generate economic gains and tangible benefits for local communities. The economic gains generated from exclosures should be sufficient to offset the cost associated with their establishment and expansion. *Second*, the economic gains should be shared with those directly affected by the establishment of exclosures. The distribution of outputs from exclosures should be fair, such that those who invest more time and effort to maintain the exclosures than do others should benefit more than them. If the management of exclosures is economically profitable, ecologically effective, and combined with a proper benefit-sharing mechanism, local communities will generally support their establishment and expansions. *Third*, development agents should provide local people with the information and knowledge that can be used to support their livelihoods and satisfy their basic needs. There is a need to sensitize the development agents to sustainable land use, agriculture, and animal husbandry.

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