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Research article

Social perception and determinants of *Ngitili* system adoption for forage and land conservation in Maswa district, Tanzania

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ABSTRACT

Understanding of the processes that determine land conservation practices is essential in designing appropriate intervention to minimise the land degradation problem. This study was conducted to assess the farmers' perception toward deferred grazing system of enclosures (*Ngitili*), examine the perceived benefits of *Ngitili* and define the socio-economic variables that potentially explain adoption of *Ngitili.* The study was conducted in Maswa district; involving a sample of 228 households. Data were collected through household survey, key informant interviews and field observation. Data analysis techniques included descriptive statistics, principal component analysis and binary logistic regression. The study findings show that 75% of farmers had adopted *Ngitili.* Farmers associated *Ngitili* system with increase in access to livelihood needs. The main benefits obtained from the system included supply of dry season forages, improved land condition and provision of household energy. The realization of benefits was generally a function of number of years a household had established *Ngitili.* The likelihood of establishing *Ngitili* was higher for household heads who were male ($p = 0.05$), and for those who had formal education ($p = 0.04$) and access to extension support services ($p = 0.02$). Other factors that contributed favourably to the adoption of this system were ownership of more than 20 tropical livestock units ($p = 0.01$) and possession of more than three plots of land ($p = 0.02$) located closer (< 3 km) to homesteads ($p = 0.01$). Factors such as land fragmentation, agricultural expansion and poor enforcement of *Ngitili* protection measures had negative influence on the system. Overall, this paper identifies the key drivers of *Ngitili* system adoption necessary to enhance land conservation and environmental protection in the semi-arid areas. To ensure sustainability of the *Ngitili* system, there is a definite need to promote the factors that enhance community participation in land conservation, improve provision of education and extension services and build strong institutions that help to regulate access and use of resources in restored areas.

1. Introduction

Livestock production in Tanzania relies predominantly on a free-ranging system. In this system, animals depend mainly on natural pastures. The amount and quality of these feed resources vary with seasons (Franzel et al., 2014). This variation affects livestock productivity (Nardone et al., 2010; Little and McPeak, 2014). In the north-western regions of Tanzania, forage conservation practice in the form of conserved enclosures (*Ngitili*) has been used for many years as a coping strategy for the shortage of forages during the dry season (Jama and Zeila, 2005; Mwilawa et al., 2008; Selemani et al., 2013). Shortage of animal feeds has been the result of unsustainable land management practices, which dates back to pre-Second World War forest clearing program (UNDP, 2012). In addition, large areas of land were devoted to agriculture so that in the mid-1980s, the collapse of ancient system of land management was imminent.

Ngitili is a silvo-pastoral system that involves retaining an area of standing vegetation (grasses, trees, shrubs and forbs) from the onset to the end of the rainy season. Areas under *Ngitili* remain closed to livestock during the rainy season (November to June). Once closed for protection, very little or no management is required. The grazing land is then reopened during the peak of the dry season (July to October) when feed resources are scarce. *Ngitili* is typically established in private farms of less than 5 ha or communal farms covering up to 50 ha (Shechambo, 2008). In essence, *Ngitili* is a farmer-led and farmer-managed vegetation restoration practice that has evolved after years of traditional grazing management.

In 1986, a large-scale Shinyanga Soil Conservation Program

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(famously known as Hifadhi Ardhi Shinyanga-HASHI in Swahili) was established in the area. The program aimed to eradicate tsetse flies which transmit trypanosomiasis, a parasitic disease that affects both humans and cattle. The program promoted the restoration of vegetation in the protected enclosures before it was closed in 2004. At the end of this program, at least 350,000 ha of *Ngitili* had been restored or established in 833 villages across the region (UNDP, 2012). Although there are records of success in rehabilitation of the degraded land on environmental conditions and improved livelihood (Kangalawe and Lyimo, 2010; Duguma et al., 2014), experience shows that human management of land changes over time with differing degree of care and perception (Shrestha and Ligonja, 2015; Teshome et al., 2016). *Ngitili* system, in particular, has been viewed as an important instrument for alleviation of forage shortage in the dry season, restoration of degraded rangelands, and soil carbon stock (Maginnis and Jackson, 2012; Selemani et al., 2013; Osei et al., 2018). However, little empirical evidence exists about the social perception of the system and what determines farmer's decisions to adopt it.

The rationale for understanding farmers' perception is based on the premise that adoption of technologies is dependent on value domains including socio-economic and moral ethics to nature. Perceptions reinforce attitudes and beliefs of reality (Getz, 1994). A farmer's attitude toward adoption of the technology is affected by his/her perception of the need for and the practicability of technology. It has been suggested that the way people think about the environment has more to do with individual differences in attitudes than with situational variables (Kortenkamp and Moore, 2001). Because none of these relationships are sufficiently understood in the context of vegetation restoration in Tanzania, a study was designed to assess farmers' perception of *Ngitili* system. A basic assumption is that sustainability of this system is a function of perceived benefits of the system itself. Thus, information on how community members perceive vegetation restoration is critical in developing better strategies for management of land resources. Without such information, well-intended policies for environmental conservation may be ineffective or even counterproductive. This study focused on the following objectives: (1) to assess the farmers' perception toward *Ngitili*, (2) to examine the perceived benefits of *Ngitili* system, and (3) to define the socio-economic variables that potentially explain the adoption of *Ngitili*.

2. Methods

2.1. Study area

This study was conducted in Maswa district of Simiyu region in north-western Tanzania from April to July, 2017. Maswa district was formerly part of Shinyanga region until March, 2012 when the region was split into two regions namely Simiyu and Shinyanga. The district lies between latitude 2°47′55"S to 3°36′15"S and longitude 33°25′25"E to 34°9′3"E (Fig. 1), and at 1, 272 m above the mean sea level. The area receives about 750 mm annual mean rainfall with the annual mean temperature of 26 °C (Saanane, 2016). The rains are bimodal. Short rains fall in November through January followed by a dry spell in February and heavy rains between March and May. Long dry season falls between May and November. The vegetation type is mainly wooded grassland (Kimwaga et al., 2012). The native vegetation is composed of shrubs (4–6 m high), often thorny and usually deciduous, and trees reaching up to 10–15 m (Kamwenda, 2002). The district has a total of 167,362 ha for grazing of which *Ngitili* covers nearly 34% of the area. At the regional level, about 292,726 ha are maintained as areas for vegetation restoration. The study area is inhabited by the Sukuma people whose main occupation is agro-pastoralism. The major crops grown include maize, sweet potatoes, millet, cassava, sorghum, cotton and rice. Cattle and goats are the most predominant livestock species.

2.2. Data collection

A cross-sectional survey was employed to collect data on adoption of and motivation for *Ngitili* in five villages namely Malekano (population size of 2,364), Mwadila (2,466), Kinamwigulu (2,700), Buyubi (1,806) and Mwakabeya (1,593). These villages are located in the northern part of Maswa district where agro-pastoral activities are more prominent than in the southern part. Estimation of the sample size (n) was performed using a formula $z^2 \times p(1-p)/d^2$ (Cochran, 1977); Where; z^2 = critical value (1.96) at 95% confidence level; p = percentage of farmers in the study area adopting *Ngitili* and d = maximum error. Because p was not known for the study population, its value was assumed to be 50% as it ensures maximum sample size. Further, a maximum error of 10% and non-response rate of 15% were assumed. The latter is the percent of farmers who would be contacted and not respond to the survey. This assumption is based on our previous experience of working with communities in Maswa district. A two stage cluster sampling technique was adopted (i.e. sampling at ward and village levels). A design effect of 2 was then used as a correction factor for the clustering effect. Thus, the estimated sample size was 228 respondents, which is twice the size that would be needed if a simple random sampling procedure was adopted. Nearly equal numbers of respondents were selected from each village as follows: Malekano (45 respondents), Mwadila (46), Kinamwigulu (46), Buyubi (45) and Mwakabeya (46).

Sample households were identified through systematic random sampling technique based on the official list of households obtained from village leaders. Field work involved a combination of household survey, key informant interviews and observation. Informed verbal consent was obtained from each participant before interviewing. Data were collected using checklists and semi-structured questionnaires. These tools were pre-tested in Bukangilija, a neighbouring village to the study area. The questionnaire elicited household information (age, education, family size, land holding, land cultivated, participation in establishing *Ngitili*, number of years involved with *Ngitili* and perceived benefits of *Ngitili*). Farmers' perception of the need for *Ngitili* was measured against fifteen deductive arguments. The measurement involved the use of a five-point Likert scale ranging from 'strongly disagree' through 'neither agree nor disagree' to 'strongly agree' as proposed by Wyatt and Meyers (1987). Key informant interviews were conducted with village elders and government officials to obtain information on *Ngitili* establishment and management practices.

2.3. Data analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS) software version 20 with an exception of specific data for which Stata (MP Version 11.2) was used to perform binary regression analysis. Descriptive data were generated for variables on household characteristics. These included mean scores which were computed for each of the motivational argument for *Ngitili* establishment. No significant variations between villages were observed and, therefore, data were pooled together in the subsequent analyses. ANOVA F-test was used to compare scores for perceived benefits of *Ngitili* in three different periods of enclosures (< 5 years, 5–10 years and > 10 years). Further, Principal Component Analysis (PCA) was performed on the fifteen factors to reduce the multidimensionality on restoration of vegetation cover (*Ngitili*). With this analysis, the underlying cluster of variables or explanatory constructs were identified. This technique decomposes the original data into a set of linear variates or components (Dunteman, 1989) and estimates how a particular variable might contribute to a component. The Kaiser-Meyer-Oklin measure of sampling adequacy (0.72) and Bartlett's test of sphericity (p = 0.00) confirmed the suitability of the data for PCA as described by Field (2009).

Data were also subjected to binary logistic regression analysis. A regression model was fitted to identify the determinants of *Ngitili*

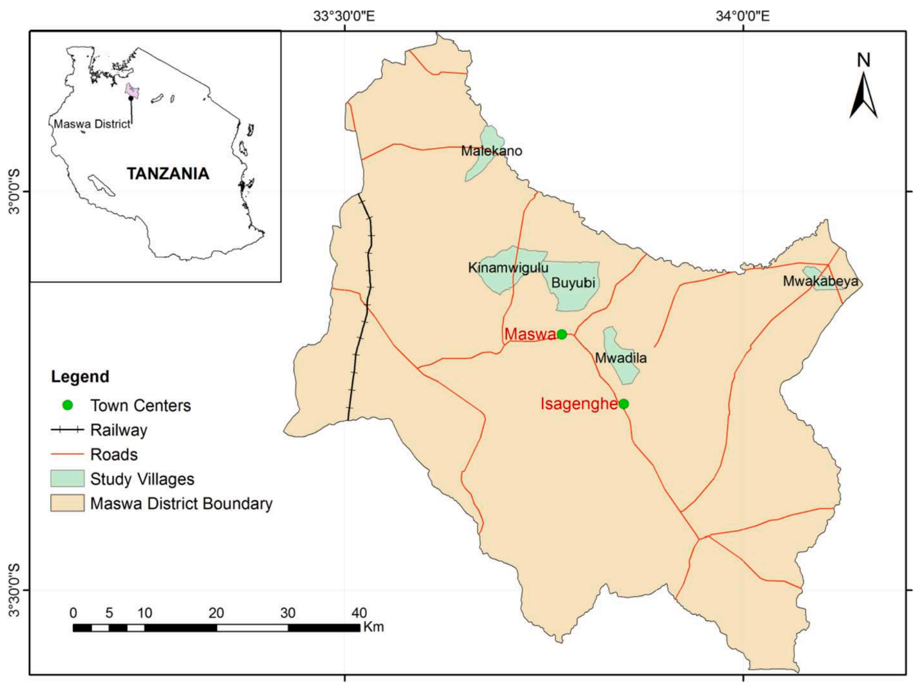

Fig. 1. Location map of the study area.

adoption. Independent variables included in the model were age of respondents, sex of the household head, education level and household size. Others were the number of plots owned, distance between farm plots and homestead, access to extension services, and the type and number of livestock owned. Inclusion of these factors in the analysis was based on the assumption that the factors could affect the decision to adopt *Ngitili*. A multicollinearity test was performed by assessing Variance Inflation Factors (VIFs). At least one predictor was dropped among correlated predictors with large VIFs (*VIFs* > *4*). The essence was to improve precision in estimation of regression coefficients. The unit of analysis was a household which operates as the ultimate decision-making unit in livelihood activities (Below et al., 2012). All independent variables were tested at the 95% confidence level to determine the significance of each variable.

3. Results and discussion

3.1. Socio-economic characteristics of farmers

The participants in this study were smallholder farmers of varied socio-economic backgrounds. Table 1 shows that households owned

Table 1
Background information of the study participants.

Variable	Min	Max	Mean	SD
Age, years	20.0	79.0	42.0	13.2
Number of years in school	0.0	16.0	4.4	2.1
Total land owned, ha	0.4	33.0	6.5	4.1
Cultivated land, ha	0.4	17.1	3.4	2.2
Conserved land, ha	1.6	8.5	2.2	1.2
Distance to conserved land, km	0.5	7.2	2.0	1.1
Number of plots	1.0	6.0	2.9	1.9
Number of cattle	6.0	120.0	25.0	11.0
Tropical Livestock Unit (TLU)	4.5	90.0	20.2	8.2
Household size	2.0	16.0	6.6	3.1
Experience in *Ngitili* of household head, years	0.0	21.0	13.0	5.2
Contacts with extension agents/year	0.0	4.0	1.8	0.7

TLU was computed based on conversion factors of 0.7 and 0.1 for cattle and sheep/goat, respectively (FAO, 1979).

one to six plots. Farmers cultivated 1–5 ha (39% of the households), 6–10 ha (24%), 11–15 ha (20%) or more than 15 ha (17%). On average, households owned 12 ha out of which, 2.2 ha were used for *Ngitili*. Although the restored patches of *Ngitili* per farmer appear small, their cumulative effect have sustained, otherwise, the degrading landscapes. The size of cultivated land reflects the fact that agricultural activities in this area are typically under smallholder farmers. Results in Table 1 also show that respondents had the average age of 42 years. Majority of these farmers were men (75%) with experience in establishing *Ngitili* in their farms. Three quarters of the households (75%) adopted *Ngitili* system and 42% of them had 10 or more years of experience with the system. Both crop cultivation and animal rearing were the main sources of income for most (71%) of the study participants.

3.2. Defining the exploratory variables for perceived benefits of Ngitili among farmers

Adoption of any technology needs to be practical and beneficial. The results from a 5-point Likert scale by years of experience in establishing and maintaining *Ngitili* are shown in Table 2. These results show that the overall mean scores of benefits were high on supply of animal feeds (4.3). One crucial element of the *Ngitili* system is the safety net function of the restored vegetation for animal feeds during the dry season. During interviews, farmers reported that *Ngitili* helps to reduce risks of losing animals for lack of feed resources. Further, environmental protection (4.1) and soil conservation (4.1) were among the most frequently cited benefits of *Ngitili*. The farmers also expected *Ngitili* to play a positive role in controlling soil erosion (4.1). Problems of soil erosion in the area are well documented (e.g. Kangalawe and Lyimo, 2010; Wiskerke et al., 2010; UNDP, 2012; Tamene and Le, 2015). In this study, there were visible features of erosion such as gullies resulting from surface runoff. Soil erosion creates severe limitations to sustainable agricultural land use, as it reduces farm productivity (McBratney et al., 2014; Amundson et al., 2015). Discussion with farmers revealed that this situation applies to their villages. Further analyses showed that as higher as 88.9% of farmers placed importance to *Ngitili* because of the need to improve land conditions. The farmers indicated that prevention of soil erosion was among the reasons for devoting their land to *Ngitili*. These findings suggest that farmers'

Table 2
Farmers' perceived benefits of *Ngitili* system.

Benefit	Mean score			Overall score	*F*-statistic	*p*-value
	< 5yrs (n = 47)	5–10yrs (n = 53)	> 10yrs (n = 72)			
Conserves soil	3.8	4.0	4.4	4.1	14.5	0.00
Protects environment	3.8	4.1	4.3	4.1	11.3	0.00
Controls erosion	3.9	4.2	4.3	4.1	5.7	0.00
Reduces land degradation	3.8	4.0	3.9	3.9	1.7	0.17
Good for supply of animal feeds	4.2	4.4	4.3	4.3	1.4	0.22
Gives higher social status	3.7	3.8	4.1	3.9	4.4	0.03
Gives high livestock returns	4.0	4.0	4.2	4.1	1.9	0.12
Reduces shortage of feed	4.2	4.2	4.2	4.2	0.3	0.74
Important for livelihood	4.2	4.2	4.3	4.2	0.6	0.50
Important for fuel wood	3.9	4.1	4.0	4.0	1.6	0.19
Provides construction materials	3.8	4.1	4.2	4.0	5.8	0.00
Improves soil fertility	3.8	3.9	3.9	3.9	0.1	0.95
Helps to demarcate land	3.7	3.8	3.9	3.8	0.6	0.55
Enhances sources of income	4.0	3.9	3.9	3.9	0.7	0.92
Important for wind breaks	3.4	3.7	3.8	3.6	2.9	0.05
Overall Mean				4.0 ± .2		

*Means based on a five-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree and 5 = strongly agree.

perception of soil erosion has become important factor in sustaining the *in situ* land conservation.

Wind break, however, was regarded as the least beneficial attribute associated with *Ngitili* (3.6), possibly because *Ngitili* plots were not always closer to home compounds where wind breaks could be most needed. The average scores of all attributes was 4.0 which indicates that the respondents scored 'agree' to most of the positive attributes of *Ngitili* explored in this study. These are but not the only potential benefits of *Ngitili*. In their studies, Monela et al. (2005) and Chirwa et al. (2015) reported a number of direct benefits of *Ngitili* presented in proportion of the respondents as follows: provision of medicinal products (14%), fodder and forage (21%), diversified diet (22%), educational support (36%) and fuel wood (61%). Further, the work of Wiskerke et al. (2010) pointed out that tree growing system in the area increases natural fertilizer by fixing nitrogen in the soil which increases crop yields. Together, these findings suggest that the objective of *Ngitili* has been expanded to services other than supply of fodder for the dry season.

Considering years of experience with *Ngitili* a farmer has had, it is intriguing to note that the realization of the benefits of *Ngitili* generally increased with years of establishment (< 5 years, 5–10 years and > 10 years). This is particularly evident in the role of the system in conserving soil ($p = 0.00$), protecting environment ($p = 0.00$), controlling soil erosion ($p = 0.00$) and providing construction materials ($p = 0.00$). During interviews, participants who had long experience with *Ngitili* gave witness that *Ngitili* had for many years supported their household needs including income from sales of tree products. Evidence presented in this section suggests that tree-based land use system has conservation value, and has positive impacts on ecosystem and livelihoods as reported in earlier studies (e.g. Reed et al., 2017; Sandberg and Jakobsson, 2018; Joos-Vandewalle et al., 2018).

3.3. Exploring benefits of Ngitili system with factor analysis

Based on Kaiser's criterion, three components with Eigen-values > 1 were retained as separate factors (Table 3). Variables with factor loadings greater than 0.5 were considered to be important attributes in a given factor. The three extracted components explain 61% of the total variance. The first factor (component 1) explains 34.4% of the total variance. It represents a concern for land conservation. Variables loaded in this factor include reducing land degradation, protecting land and controlling soil erosion. In this case, *Ngitili* is regarded as a system that improves farming conditions. Indeed, studies in Ethiopia (Mebrat, 2015), Kenya (Wairore et al., 2015), China (Mu et al., 2013; Shang et al., 2017) and Botswana (Teketay et al., 2018) all illustrate that enclosures present a successful management tool for regeneration of vegetation and restoration of degraded land. In the most severely degraded semi-arid rangelands, however, withdraw of grazing is often not sufficient to foster the autogenic recovery of the vegetation (Verdoodt et al., 2009).

Table 3
Rotated pattern matrix for benefits of *Ngitili* system.

Factor	Rotated factor loadings		
	1	2	3
Reduces land degradation	**0.858**		0.142
Conserves soil	**0.818**	0.110	
Controls soil erosion	**0.759**	0.233	
Increases returns to livestock production		**0.796**	
Gives higher social status	0.271	**0.712**	
Ensures good supply of animal feed	0.365	**0.555**	0.169
Protects environment	0.222		**0.857**
Good source of supply of fuel wood	0.485		**−0.502**
Important for livelihood		**0.638**	
Variance	34.4	15.3	11.4

Extraction method: Principal component analysis. Results are based on Rotation method, Varimax with Kaiser Normalization. Factor loadings with absolute value greater than 0.5, appear in bold.

In the current study, farmers raised concerns on land degradation not only for its negative effects on land productivity but also for making land unsuitable for cultivation. Results from household survey indicated that farmers expected vegetation restoration to improve land condition through reduced water runoff. This reflects the views of farmers that declining land productivity and land clearing are among the reasons that prompted the establishment of conservation areas. The results corroborate those by Jama and Zeila (2005), that the system has the potential for improving site ecology because trees enrich soil surface through litter fall, decomposition and mineralization. Additionally, extensive ground cover in the enclosed area helps in ameliorating and reducing soil erosion in the dry lands as reported in previous the studies (e.g. Guo et al., 2014; Mureithi et al., 2016).

The second factor (component 2) explains 15.3% of the total variance. It relates to livestock production and associated benefits. Variables highly loading on this component included returns to livestock production, higher social status, good supply of animal feed and its overall importance for livelihood. The last factor (component 3) accounts for 11.4% of the total variance. This factor is strongly loaded with two variables namely environmental protection and supply of fuel wood. Discussion with farmers revealed that the basis for concern on environmental protection was anthropogenic rather than ecocentric motives, as reasons were invariably rooted on the need for increase in livelihood support. The second variable (supply of fuel wood) matches the findings from key informant interviews that *Ngitili* had reduced the need to travel long distances to collect firewood. It also reflects earlier findings that the system minimizes shortages of fuel wood and time spent collecting fuel wood by 2–6 h per day; signifying less dependence and reduced pressure on rangeland resources (Jama and Zeila, 2005; Monela et al., 2005).

All factor loadings in the PCA analysis had positive coefficients except for fuel wood (Table 3). The negative factor loading of fuel wood could possibly be the result of decreasing availability of wood resources due to overharvesting and land clearing, making wood more scarce and difficult to obtain. In this study, almost all respondents indicated that availability of firewood was low as compared with the situation in the past 10 years. With reference to energy supply, it is important to note that biomass use accounts for over 90% of energy consumption in Tanzania with firewood and charcoal being the most common types of energy sources utilized (Felix and Gheewalaa, 2011; URT, 2016). Indeed, scarcity of energy sources is a livelihood concern in many rural areas given the increasing population size, overexploitation of plant resources and the changing climatic conditions as reported in earlier studies (e.g. Kaygusuz, 2011; Mengistu et al., 2015; Biggs et al., 2015). Overall, the study findings indicate convergence of views about land conservation, livestock production and environmental protection as the most beneficial aspects of restoration of vegetation cover in the study area. Further, results in Table 3 show that each of the nine individual items loaded strongly on only one of the three factors. This means that the three factors are separable dimensions of the felt needs for *Ngitili,* and that the items in each dimension are non-overlapping.

4. Determinants of adoption of *Ngitili* system

Logistic regression results on the factors associated with adoption of *Ngitili* are presented in Table 4. Findings show that socio-economic factors and access to extension support services were mainly responsible for the uptake of the system. For instance, formal education increased odds for adopting *Ngitili* in comparison with those who had not attended school ($p = 0.04$). This observation is likely to be a result of increased awareness on the benefits of land conservation among members of the former category. These findings point to the need for the public support in educating children so that future generations will be better able to manage their local environment. Owning cattle also increased the likelihood of households having *Ngitili* ($p = 0.04$) because of needs for the dry season forages. Further, consistent with the previous studies (e.g. Di Falco and Veronesi, 2014; Shrestha and Ligonja, 2015), access to extension services increased chances of farmers to conserve environment.

Unlike many parts of the country where extension services are limited, farmers in the area acknowledged that they received such

Table 4
Regression summary for factors influencing adoption of *Ngitili* system.

Variable	B	Std. err	Exp(B)	Z	$P > \|z\|$
Sex of head of household is male	1.02	0.37	2.8	2.77	0.05
Respondent attended formal education	1.12	0.40	3.1	2.80	0.04
Distance between homestead and farm is < 3 km	0.56	0.23	2.4	2.61	0.01
Respondent has access to extension services	0.48	0.17	1.6	2.82	0.02
Household owns > 3 plots	0.62	0.26	1.9	2.38	0.02
Household owns > 25 cattle	0.56	0.27	1.8	2.08	0.04
Household owns > 20 TLU	0.41	0.13	1.5	3.15	0.01
Owns total land of > 7ha	0.22	0.08	1.2	2.57	0.04

Number of obs (228), LR chi2 (8), Prob > chi2 = 0.000, $R^2 = 0.61$.

services more from the HASHI program and the Natural Forest Resource Management and Agroforestry Centre than from the government. Short distance (< 3 km) between *Ngitili* plot and homestead was favoured for ease of protection of the areas ($p = 0.01$). The odds for establishing *Ngitili* were higher ($p = 0.02$) among individuals who owned more than three separate plots. Overall, these factors contributed favourably to the adoption of *Ngitili*. Nevertheless, two important factors had negative influence on establishment and management of *Ngitili*.

The first factor relates to the shrinking land size. About 46% of farmers reported that *Ngitili* reduces land area for farming. This is particularly true given the declining land holdings per household due to high rate of population growth. The study area has a population growth rate of 3.3% per year which exceeds the national rate of 2.7% (URT, 2013). Discussions with district officials indicated that conversion of areas with natural vegetation into agricultural land is exacerbated by the famers' low capacity to purchase agricultural inputs which would increase agricultural productivity. Conversely, intensifying agriculture is likely to spare land for nature as, for a fixed demand, higher crop yields decrease the area that need to be cultivated (Bruinsma, 2017). Without agricultural intensification, the villages will require more land area to meet food demands. In this regard, support for best practices in agronomic activities and natural resources management through extension services is crucial in promoting land conservation practices.

The second factor is linked to the limited capacity of institutions that govern the use of land resources. It was observed that local institutions particularly, the village councils and other informal institutions were involved in regulating access to *Ngitili* albeit at a minimum capacity. The later include assemblies of elders known as *Dagashida.* These assemblies decide which sanctions to impose on individuals who commit offences on rules for *Ngitili* restoration and management. In some cases, the villages used *Mbagashula*, a non-elected leader with vested powers to punish defaulters. Notwithstanding the existence of specific rules for the communities' use of conserved areas, the present study found that enforcement of these rules was rather weak and the evolved pro-conservation norms were not always sufficient to restrict access to restored areas. Taking the case of *Dagashida,* Duguma and Minang (2014) asserted that this particular assembly is tasked with conflict resolution and serves as a mediator between the traditional and formal institutions. However, 49% of the study participants indicated that these assemblies were not strong enough to protect the conserved areas. This situation could be attributed to the ever increasing number of users of feed resources because as users increase, agreeing on rules and enforcing the rules becomes more difficulty. It is also possible that community members no longer uphold to the traditional laws and customs as much as they did in the past.

Elsewhere, it was reported that traditional institutions were increasingly unable to exert sufficient control over the exploitation of forest resources (Ananda and Herath, 2003; Jayne et al., 2014). The authors pointed out that sanctions for the abuse and misuse of these resources were not as effective as they used to be three decades earlier. This might explain why incidences of disputes being adjudicated by *Dagashida* or referred to judicial courts for resolution, for example, were reportedly few even though claims of herders grazing illegally were not uncommon. This problem was more frequently reported in the communally owned *Ngitili* where property rights are not well defined. These results provide further evidence of the management challenge for common pool resources in which exclusion of beneficiaries through physical and institutional means is especially costly (Ostrom et al., 1999; Gardiner, 2001; Tosun et al., 2016). In this case, adoption or scaling up of *Ngitili* system appears to be constrained by inefficiency of the institutions expected to promote it. The findings also suggest that despite the wide ranging significance of the *Ngitili* system, little evidence exists on the actions designed to ensure the long-term sustainability of the system.

5. Conclusions

This study has assessed the farmers' perception and the benefits of *Ngitili* system as forage and land conservation strategy in Maswa district. Further, the study has highlighted the interplay of the factors that shape the adoption of *Ngitili* system. In general, communities in the study area have positive perception on the system given its role on land conservation, provision of grazing reserves, environmental protection and wood supply. The main drivers of *Ngitili* adoption are the needs for the dry season forages and benefits associated with livestock production, improved land condition and supply of household energy. These aspects present the main issues with high degree of similarities in community response linked with the benefits of the *Ngitili* system. Restoration of vegetation is also the result of perceived intangible benefits of environmental protection. The uptake of *Ngitili* was dependent on the various socio-economic characteristics of the community members including formal education of the household head and land size or plots a household possesses. The findings of this study have a number of important implications for future vegetation restoration practices. First, continued efforts are needed to build strong institutions and promote the factors that enhance participation in land conservation. Such factors include provision of environmental education and extension support services. This is particularly important given the variations in perceptions of *Ngitili* establishment and of the benefits this creates for community members. Second, collective action involving government, non-governmental organizations, farmer organizations and other stakeholders working with sectors such as livestock, agriculture and forestry is crucial to ensure the long-term sustainability of the *Ngitili* system of enclosures. Third, social economic factors vary in their effects on *Ngitili* system adoption, and determine whether individuals will take actions that facilitate or undermine the system. Understanding of these factors can help determine interventions at scales ranging from adoption to management of *Ngitili.* Future efforts toward environmental conservation should include promotion of the factors that support conservation initiatives. In general, this study has revealed the social perception of *Ngitili* system. Further research is needed to generate empirical evidence on the role of enclosures in enhancing the recovery of vegetation and the effect it has on the physical environment, flora and fauna communities in different agro-ecological zones in the country.

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