

Study on the status and impacts of land use types on access to and management of rangeland: The case of Borana Pastoralists, Ethiopia

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Abstract

The study was undertaken in Borana zone, southern Ethiopia. Borana is a pastoral community and relies on livestock production as a basic livelihood. For Borana, livestock is everything; it illustrates sociocultural and economic status. In turn, livestock is dependent on rangeland resources because the community lives in a remote area and their livelihood is interlinked with rangeland resources since rangeland is the main resource available in the dryland area. In turn, rangeland is found in where rainfall is variable and therefore difficult for other rural enterprises. But relatively livestock rising is more feasible because they can move in searching of available pasture and water where available. Such livestock mobility is a cultural technique and usually practiced by pastoralists to safe livestock and manage rangeland. However, the mobility practice including other indigenous knowledge of the pastoralists' have been undermined by land policy formulation in the country. And then, followed enforcing pastoralists to limit mobility practice, reduce livestock number, and practice different cropping activities by adopting different land-use changes. Currently, the land-use changes that have broadly been practiced in the area are two: Communal enclosure and private enclosure, which are shifted from pastoralism production system to agro-pastoral production system. However, such land-management system through these land-use changes are strongly claimed as they brought degradation of the rangeland resources and declines rangeland size. So, the current study was aimed to identify land-use types and their impacts on pastoral production system. Accordingly, the study used desk review and secondary data from 360 randomly sampled households. Descriptive statistics and econometric models (OLS and Ordinal logit regression) were used with Stata-14 for the analyses. The descriptive findings indicate 74% of households depend on pastoralism activity while 26% on agro-pastoralism. The result interprets that despite long year intervention has been practiced in the study area, still a significant number of the households are following the traditional activity. This reflects that pastoralists' interest is to follow the traditional type of production system despite Government enforcement. Regression results have also confirmed that the negative consequence of both the land-use types on access to rangeland and management of rangeland with a significant test. Therefore, the study concludes, the top-down approaches that are practiced in the study area have inversely affected both rangeland access and quality. So, it will be better if policymakers viewed rangeland in terms of ecology, cultural relation, and indigenous knowledge for the rangeland management for the study area.

Key words: Impacts, Land-use change, Land access, Rangeland, Indigenous practices

Introduction

Borana is a pastoral community, found in southern part of Ethiopia (Markus, 2013). They relied on rangeland resources as the backbone (Wairore *et al.*, 2015). Economically, rangeland provides pasture and water for livestock; socially, communal rangeland is an indicator of social organization and ancestral territory; politically, the pastoralists have set their leadership through clan system which has based on communal land owned; culturally, rangeland is the resources where pastoralists can practice their indigenous practice ((Napier & Desta, 2011; Elias, 2008; Mcpeak & Little, 2019). However, to sustain the rangeland with these multi affordability, identification and recommendation of best rangeland management system is required because their livelihood is function if rangeland is workable. As recent studies' justification the most appropriate for rangeland management system is through extensive use of grazing system with performed cultural practices. Such a system is believed to enable pastoralists with full power over their resources and cultures, and then led them more successful in resources management. This has already been confirmed as cultural-based land management is more effective in the case of Borana pastoralists (Markus, 2013).

However, since 1974, the pastoralists' land holding systems are disturbed due to the frequently land-use changes that have been imposed by the Government policy (Elias, 2008). The systems cause continuous shrinkage of rangeland size (PFE *et al.*, 2010) and rangeland degradation (Flintan, 2011). The threatening of rangeland size and rangeland quality could cause deterioration of the pastoralists' social organization, undermining their customary rule, and disregarding their cultural practices. In turn, as cultural practices and customary rule have deteriorated, their capability to cope with drought shock would be weakened and cause rangeland degradation (Elias, 2008). And then, it extends to worsening the pastoralists' long-term livelihood. So, to improve pastoralists' livelihood, focusing on rangeland size and management technique are relevant. Otherwise, the rangeland size and management system that have been radically changed over the past many years will continue to challenge for future generations.

Currently, in Borana, the bottleneck problem that pastoralists face is the increasing trend of rangeland shrinkage (PFE *et al.*, 2010). Because extensive use of rangeland (large size) is a key livelihood for pastoralists as it invites cultural activity and social integrity. PFE, IIRR and DF (2010) reported, without accessing large rangeland size it is no longer possible to define pastoralism. This implies, shortage of rangeland is a serious threat for pastoralists' livelihood (ibid). Yong-dong *et al.* (2018) describe rangeland as the resources that maintain healthy and productive livestock for pastoralists' livelihood. This implies requirement of special focus for the best means for rangeland management to improve pastoralists' livelihood. As Wesche *et al.* (2010) highlighted, a healthy way of rangeland management is through mobility practices. The

study of Elias (2008) suggested as rangeland improvements require mobility, traditional institutions, and indigenous knowledge. However, the land-use changes levied in the study area have no space for such traditional systems. Due to that the customary system is continuously challenged and weakening in the study area (Elias, 2008). However, the pastoralists' customary institution has also strongly resisted the top-down approaches (Flintan, 2011). In the middle, pastoralists' livelihood is continuously threatening as the traditional system is weakening and the legal system is less accepted.

Currently, in Borana, rangeland is administered by two contradicting Governments. One is the customary rule and the second is the statutory rule (Abdul *et al.*, 2004). The customary rule is governed by the traditional institution called *Gada* system. The *Gada* is a traditional institution that has been practiced since 16th century by the Oromo ethnic group ("Gadaa," 2014). In progress, the institution becomes weakening in some parts of the Oromo community but remain functional by Borana pastoralists (Edossa, Babel, Gupta, & Awulachew, 2005). *Gada* system governs the pastoral community based on its own structural set up separately from the formal Government.

The formal institution has also its own administration line in the study area but less respected in by the pastoral community. Concurred to the pastoralists' interest many studies have justified as the *Gada* system is more relevant for pastoralists' livelihood especially on land management (WB, 2005). But its role in land management is less recognized by the Government of the country rather it is recognised as cultural value alone.

Nowadays, in the study area, implementation of land use changes is on progressing by pastoral development and Government bodies having the idea of pastoralism production system is backward activity. Their agenda is shifting pastoralism to agropastoralism production system. The agropastoralism system limits mobility practices and reallocates rangeland for different land-uses. But mobility is the way for efficient use of forage resources produced in arid areas (Brent, 1993). Certainly, the agropastoralism production system is criticized as less relevant for the dryland agroecology and pastoralists' experience (Mcpeak & Little, 2019). Likewise, it is reported that the development intervention on land-use changes are not consistent, and not promised-based (Napier & Desta, 2011). For instance, they propose communal enclosure for pastoralists' livestock grazing but later they have changed it to hay production for commercial purposes at the expense of the pastoralists' livestock (ibid). Following this argument, Li (2014) has reported, the so-called investment and conservation strategy is the actions of the frontier mentality and the way for land grabbing.

Currently, dominant land-use changes that are practicing in the area are communal rangeland

enclosures¹ and private rangeland enclosures. These land-use changes have emerged from the agropastoralism production system. But as the production system is in contrary of pastoralists' land and cultural context (Elias, 2008), some pastoralists continued with their customary based communal grazing system following mobility activity while an increased number of pastoralists are following the newly imposed land-use types, due to pressures, motivations and advice made from Government and pastoral development workers. Government effort is to improve pastoralists' livelihood, but little success was observed on pastoralists' livelihood improvement (Liao, 2014). Usually, the negative consequences of the land-use changes are clearly and immediately observed on livestock loss (Elias, 2008). But the impact extends to their entire livelihood because livestock is the lion share of income sources and the most factor for social status for Borana pastoralists (Gemtessa *et al.*, 2005). That means the land-use changes are not just bringing livestock loss alone, but also cultural, social, and political dead. Because the pastoralists' social, cultural, and political systems highly depend on livestock and rangeland resources. This indicates, in the study area, the interrelationship of the community is deeply grounded on livestock asset and communal rangeland owned. So, any practices that could limit communal rangeland size and quality of rangeland could affect pastoralism production system. The current study also aimed to generate evidence-based information on land-use changes and its impacts on the pastoralism production system. To inform policymakers on what has gone wrong and should be refocused on the sign and significant impacts of the land use types; and to aware pastoral development policy as pastoral land should be valued in terms of context based.

Definitions of the terms

Traditional land holding system: - Since the 16th century, Borana pastoralists have ruled by customary institution called *Gada* system that has been played a significant role in their livelihoods ("Gadaa," 2014). Specifically, *Gada* system is more focus on resource use-regulation, conflict resolution, and wealthy share arrangements (*ibid*). As a result, the pastoralists are recognized as have unique capability in managing rangeland resources as they have ruled by the *Gada* system, which is known as strong and democratic leadership (WB, 2005). In turn, the institutional functionality is based on communal land owned, and hence has paid special focus to rangeland management because it is all indicators of their socio-cultural identity and political functionality beside economic affordability (*ibid*). Therefore, in the study area, land management is easy as it tied to their socio-political daily activities. For instance, their leadership structure is identified through

clan-arrangement, as well as clan organization is based on communal rangeland management. So, land management is easily practiced based on the clan structure, that the landholding system is relating to kin membership and has well-defined territories that identify them from other clans (Mcpeak & Little, 2019). Thus, rangeland owned by a certain group/clan is not easily grazed by other users without asking permission of the area community (*ibid*). In other case, this indicates the grazing system of the study area is different from that of the open grazing system or tragedy of the common.

For regulation of the resource use, *Gada* councils have responsible at each structure. Thus, the rangeland resources (grazing land and water points) are controlled by *abba dheedaa* (grazing leader), and *abba eelaa* (water manager) (Mcpeak & Little, 2019). Further, for best management, traditionally rangeland is divided into five *dheedaa* places (grazing field) which are located at different places based on agroecology of the area (Mcpeak & Little, 2019). Beside rangeland management responsible, the traditional rule has paid careful attention to keep their livestock breed to be unmixed. Because their livestock breed has a unique capability of coping with the area's climate (Reddy, 2018). For instance, Vastrap (2020, p.2) explains the breed as: - "The Borana breed [...] is humped medium-framed animals with sound muscling and large capacity for size." This implies the livestock behaviour is one factor for pastoralism production system decisions and success. Similarly, PFE *et al.* (2010) reported, in the study area disease situations are very problem for camel raising, and due to that, they couldn't stay one place for more than seven days. And notes as the animals' behaviour and climate difficulty force pastoralists to follow cultural practices like mobility). Further, Borana's traditional landholding system is interconnected with ecological system (Masuku, 2013) that depend on livestock as a single most important resources that has directly linked to rangeland resources and cultural practices to cope droughts (Gebisa, 2018). This implies making a good environment for livestock production is one way of pastoralists' livelihood improvement.

In the study area, livestock production is more grounded on pastoralism (transhumance) as they are featured by mobility practice. Mobility is commonly used as a key strategy to balance grazing resources and cope with environmental drought (Gebisa, 2018). The practice is intentional, scheduled, predicted, reasonable, and productive (Mcpeak & Little, 2019). In turn, mobility is enhanced when rangelands are contiguous and not fragmented (Johnsen, Niamir-Fuller, Bensada & Waters-Bayer, 2019).

Traditionally and uniquely, Borana pastoralists have practiced two types of livestock herding structure based on rangeland resource and livestock characteristics for

¹ It is a type of communal enclosure that owned by cooperative, that implemented by external and hold by pastoralists (included for the study). But

there is traditional communal enclosure (settlement based) that used for calf and week animals during dry season (is not included in the study).

rangeland management. The first herding system is practiced at home-based with milking cattle, calves, and offspring animals by allocating small portion of enclosed rangelands and locally called *warra* (meaning near the village) (Gebisa, 2018). While the second herding system locally called *forra* (meaning far from home), which follows herding practices away from home, and livestock included are bulls and all young stocks (ibid). In the study area, except for the above purposes (i.e. milking cattle, calves, and offspring animals), individual or communal enclosure is strictly forbidden according to Borana *Gada* system (Gebisa, 2018). However, the land reform made by the country Government force pastoralists to adopt agropastoralism production system at the expense of the traditional practice (pastoralism production system).

Currently, the Borana production system characterized as pastoralism and agropastoralism, despite Borana rangelands are unsuitable for other purposes except livestock herding (Gebisa, 2018). Agropastoralism production system focuses expansion of crop cultivation while causing shortage of land allocation for livestock grazing (FAO, 2016). However, access to rangeland is determinant factor for pastoralists' livelihood because the pastoralism production system demands extensive production system since climate variability forces them to practice mobility in a large land size. Concurred to the point, Young et al. (2005) justified, economic development based on livestock production is no longer possible in the absence of security and mobility for pastoralists. So, having less rangeland size, limited mobility, and disregarding livestock production are not seem decent sound for the study area.

In the study area, the land use changes are not only ignoring mobility practice and livestock production but also hampering the *Gada* system that grounded on land management system to custom the community's livelihood. *Gada* system was the indigenous governing system that was governing whole Oromo ethnic group of Ethiopia in the past. However, it becomes weakening and disappear in highland inhabitants while remain functional in a few areas including Borana (Berhane, 2016) but it is on declining stage too at current due to the land-use changes progressed in Borana pastoralists.

Land use changes: -Land-use changes refer to the quantitative changes (increases or decreases) of a given type of land use (Briassoulis, 2011). Land-use change has different purposes associated with land resources that can affect land in several ways (ibid). Positively, land-use change is aiming to promote conservation of natural resources, especially in the degraded area to retain the depleted resources (Herrick et al., 2012). In another way, land-use change, especially, reallocation of pastoral land to cultivated land is imposed when per-capita consumption of food is highly demanded in case of human population increased (ibid). In other cases, land-use change is imposed when land values have been defined narrowly (Li, 2014). However, imposition of land-use change demands careful attention, especially if owners are indigenous people because land has a different meaning

for different people (Li, 2014). For instance, for pastoralists, their land is their identity, where they can practice their cultural activities and indigenous knowledge. So, disregarding the traditional practices over resource management affects livelihood of the community in multi direction. Kimiti, Western, Mbau and Wasonga (2018) agreed with this point and reported, rangeland alteration through land-use change affects ecology of the world in the long term and then affects livestock production and human livelihoods. Flintan (2011) reported, in the study area the imposed land-use changes led pastoralists into extreme poverty because interventions on expansion of crop cultivation, private and communal enclosures are not feasible given the climate difficulty and social relation of the community based on communal land.

Private rangeland enclosures: - In Borana, two types of private enclosures are already situated. First, the one that has been culturally practiced by pastoralists while the second is the externally imposed by development policy (Napier & Desta, 2011). The traditionally practiced is reasonable and allowed by the customary rule. The practice is based on age and gender differences of household family, with livestock splitting based on purpose, age, and health status of the livestock (Yongdong et al., 2018). Accordingly, small to medium size of rangeland enclosures are used as grazing reserves and set home nearby (ibid). The enclosure has specified functions and size. Consequently, rangeland allocated for calves is locally called *Seera Yabbi* (which means, rule of calves or for calves). It has small size, non-fenced, and individually owned at home side (Napier & Desta, 2011). While the second is semi-private/communal enclosures which is larger in size (ibid). This type of land access is as collective form and it has protected by physical fence or customary law, and purpose of the pasture is for weak and ill cattle rather than calves (Napier & Desta, 2011). Beside the above traditional practices, the newly imposed private enclosure is also practiced since the recommended land-use change for the study area. Their interventions are top-down approach and less consider of the pastoralist's social relation to land; limited mobility and limited livestock splitting contradicting the traditional practices.

Currently, the private enclosure land-use type is actively practicing because of related NGOs and Government initiations, but at the expense of the communal rangeland (i.e. traditional practices). For instance, Napier and Desta (2011) reported as: "The number of enclosures in Borana is increasing and the land available for communal grazing is reducing." (P. 14). This implies, expansion of private enclosure brings fragmentation of traditional based communal grazing into many different small plots and shrinks rangeland size for livestock grazing (Flintan, 2011).

For the current study, the households' response on the involvement of private enclosure is used as one variable with the assumption of negative influence on access to rangeland for pastoralism production system. For instance, PFE et al. (2010) noted, as rangeland individualization is shrinks communal rangeland, and

affects pastoralism production development negatively (Flintan, 2011). However, in the case of rangeland management, practicing private enclosure may influence either positively or negatively the rangeland quality. As understood from the study of Napier and Desta (2011), land enclosure may protect the land from unregular grazing and could retain land. Wairore *et al.* (2015) also justify as enclosures are important as it protects land from the interference of both humans and domestic animals to reduce land degradation on formerly degraded communal grazing land. This implies, private enclosure can affect performance of rangeland management positively. Indeed, the assumption of the negative result would be expected in case of limiting livestock mobility that make pressure on available land resources throughout the year without rest. Study of Waiganjo and Ngugi (2001) conducted in Kenya, on effects of existing land tenure systems on land-use, and reported, land individualizing to small parcel resulted in either overgrazing, soil erosion, or other poor farming practices. So, development ideas, like privatization that challenge mobility practices resulted in deteriorating the pastoralists livelihood (Annemiek & Daniel, 2017).

Communal rangeland enclosures: -The second land-use type expanded in the study area is communal enclosure. In Borana zone, the overall trend of rangeland using system is communal grazing, which is governed by traditional rule, but due to the start of Government interventions the customary system becomes weaken and the common grazing type overlapping with open grazing system (Gemtessa *et al.*, 2005). In the area, besides traditional based communal grazing some extent of communal enclosure is also practiced by pastoralists for reasonable purposes based on customary law (Napier & Desta, 2011). Having this as initial points, different NGOs and Government partners have introduced communal enclosures in the area. Unlike the traditional enclosure, the imposed enclosure has multi-objectives like hay production for fattening and renting of grasses to livestock traders or investors at the expense of pastoralists' livestock feeding (Napier & Desta, 2011). This indicates that in the study area, interventions are more considered for diversifying income sources rather than improving rangeland management. But given the context of ecology of the area and the pastoralists' experiences, disregarding rangeland management does not seem feasible. For the current study, participants of such communal rangeland enclosure, that was imposed by external pressures and currently practicing by the community for different purposes have been considered as one independent variable to explain access to and quality of rangeland (grazing land for their livestock). The hypothesis is as the communal enclosure is expanded or practiced by many pastoralists the available rangeland (customary based communal land) will be declined. In other cases, as communal enclosure is allocated for different purposes, grazing land for their livestock is declined. So, it would have a negative impact on access to rangeland for livestock. Again, as the system limits mobility practices,

staying livestock on a limited site make pressure on rangeland and causes degradation.

Rangeland and access to rangeland: -Rangeland is a type of land that largely provides grasses, grass-like plants, and shrubs that are indigenous vegetation and are used primarily for feeding livestock and wildlife ("Rangeland," 2020). Concurred to this, Wairore *et al.* (2015) justified that rangelands are predominantly for grasses. Because rangeland is characterised by rainfall variability, where fruitful crop production cannot be attained (Tolera & Abebe, 2019). This implies allocating rangeland for other purposes rather than livestock production is less feasible.

Rangeland management: - Organisation for Economic Cooperation and Development (OECD, 1997) defines rangeland management as a capable of providing conservation for rangeland resources to ensure consistent livestock production. However, as rangeland is found in harsh climate and used under indigenous pastoralists, climate-based and experience-based management system is required. Effective rangeland conserve is successful through livestock mobility (Mathew *et al.*, 2014), which allows rotation and recovery periods, and conserves biodiversity (Wesche *et al.*, 2010). This implies rangeland management is highly effective if traditional practices are allowed. However, in the study area, rangeland management under private and communal enclosure is increasingly likely that are imposed by external force contradicting the traditional system (Sisay, Flintan, & Solomon, 2015).

Methodology

The study area: Borana is located to Southern part of the country (Figure, 2) with 3°36' – 6°38' North latitude and 3°43'- 39°30' East longitude and bordered by Kenya in South (Lasage *et al.*, 2010). Elevation ranges from 1000 to 1700 meters above sea level, and receiving bimodal rainfall, long rainy season is from March to May, and short rains in September to November months, then, long dry season followed (Tilahun, Teklu, & Hoag, 2013).

Borana zone is one of the 21 zones of Oromia regional state of Ethiopia. The Borana administrative zone is further subdivided into districts and contains thirteen districts (Faku, 2014) namely Gomole, Dubluk, Elewaye, Guchi, Dhas, Yabello, Arero, Moyale, Dire, Taltale, Wacile, Dillo, and Mi'o. Yabello is the capital town of the Borana zone (Doyo *et al.*, 2018). For the study, considered districts are: - Yabello, Arero, Dire, Mi'o, Taltale and Dillo.

For the study both qualitative and quantitative methods were used. Data sources would be literature reviews and quantitative data from secondary sources. Data was from 360 respondents who were randomly selected from 6 districts. Descriptive statistics and econometric models were applied for the analysis. Descriptive statistics used to analysis demographic and socioeconomic characteristics, showing size of different land use types, and evaluation response on quality of rangeland in the study area. For the

analysis of impacts of land-use changes, econometric models (OLS and Ordinal Logit) regression were used.

Multiple regressions using OLS method was applied after the data sets were transformed to log form to run influence of land use changes on size of rangeland (access to rangeland). The model was proposed to estimate the impact of a variable of interest x on an outcome of interest Y , keeping another variables D constant, and displayed as:

$$\text{Log}(Y_i) = \alpha + \beta_1 X_{1i} + \dots + \beta_n X_{ni} + \gamma_1 D_{1i} + \dots + \gamma_k D_{ki} + \varepsilon \quad 1$$

Where, $\text{Log}(Y_i)$ = Log of total land size allocated for livestock grazing (ha) by i households; X_i = independent variables (land use types) and D_i = demographic and socioeconomic independent variables; α = intercept; β and γ = are coefficients; and ε = the error term. The equation is adopted from Mekuria and Mekonnen (2018) applied for Determinants of crop–livestock diversification in the mixed farming systems in Ethiopia.

The second model, Ordinal logit regression was applied for evaluation of rangeland management based on multiple discrete type of dependent variables (very poor, poor, good, very good). Model specification for ordinal logistic regression is as the following:

$$\text{logit}[p(y \leq J)] = \beta_0 + \beta_1 X_{1j} + \dots + \beta_n X_{nj} + \gamma_1 D_{1j} + \dots + \gamma_k D_{jk} + \varepsilon \quad 2$$

Where, J = for 'J' levels of ordinal outcomes, the model makes 'J-1' for predictions; y = Outcome ordinal ranked values with J categories (very poor, poor, good, very good); X_j = land use types and, D_j = demographic and socioeconomic independent variables of j th pastoralists; β_0 = intercept; β and γ = are the vector of regression coefficients; and ε = the error term. The equation is adopted from (Reddy & Alemayehu, 2015).

Accordingly, main independent variables used to predict access to, and management of rangeland are communal enclosure and private enclosure.

Communal enclosure - This is a dummy variable and measured as, if households are involved in communal enclosure for their livestock it labels 'yes' (1 = yes, 0 otherwise). It is hypothesised that the one who practicing communal enclosure affects rangeland size for livestock negatively. But it might have less impact than the privately enclosure one. As Napier and Desta (2011) noted, communal livestock enclosure is better fit pastoralists livelihood than the individual livestock enclosures because it allows land fragmentation less than that of the privately owned. But it might be more fragmented and less fit than the traditional based communal grazing and, therefore expected negatively affect rangeland access. As communal enclosure limit mobility it made pressure on same land for year-round and increase land degradation. So, expected as negatively affect rangeland quality or explained as reduce rangeland productivity.

Private enclosure - This is a dummy variable and measured if households have a private enclosure for their livestock it is coded as 'yes' (1= yes, 0 otherwise). It is hypothesized as households are practicing private enclosure it affects rangeland size negatively. Because it fragmented communal rangeland into different plots (Napier & Desta, 2011). As Mcpeak and Little (2019) found, Borana pastoralists strictly oppose the individualized tenure system as it competes for communal rangelands.

In the case of rangeland quality, the study would expect either negative or positive impact of the land-use types on rangeland quality. First, since no mobility is practiced, the land is grazed all year round without rest, then cause degradation. In addition, fragmentation of land into different size brings land wastage as boundaries of land covered by fences. Flintan (2011) has noted, fragmentation of rangelands to different small plots exposes land for extreme degradation. So, expected negatively influence rangeland management performance. But Wairore *et al.* (2015) justify as private enclosures are important as it protects land from the interference of both humans and domestic animals to reduce land degradation on formerly degraded communal grazing land.

Controlled variables- In addition to the main variables discussed above, demographic, and socioeconomic variables would be included as control variables to neutralize the estimation results. These variables are gender of household head, age of household head, education status of household head, livestock holding (TLU) and training on rangeland management.

Gender of household head – is a dummy variable (1= male; 0 = female). It is hypothesised that the male headed household has positive impact on land access and management. Omollo, Wasonga, Elhadi (2018) noted, in sub-Saharan Africa, female-headed households have less access to any productive resources including land. According to the study assumptions, female headed households may be less able to participate in far mobility practices even if they remain member of the clan and then less access to large area of rangeland for their livestock. Most of the time widows joined to the closest *dheedaa* and communal enclosure regardless of land size differences. In addition, female households may not defend and fence large private enclosure while this remains easier for male household head. In the study area, rangeland quality is managed by clearing bush, fencing, and defending boundary. In this case, male headed households are more effective than female headed households. Indeed, women's primary activities are child caring, cooking, collection of firewood and fetching water while practice of livestock keeping and management are a secondary activity (Guyo, 2017). This suggests male households are more experienced than female households. Therefore, the variable may influence land management positively.

Age of household head – is a continuous variable, measured in year. It is expected as either positively or negatively affecting rangeland quality but expected

positively affecting size of rangeland. As age increased households have better rangeland management skill and expected positively influence rangeland management. Concurred to the assumption, Mohammed *et al.* (2013) found positive correlations of age with rangeland management. For the negative assumption, as age increases, they assess different things and under evaluate the current situation related to the past. Omollo *et al.* (2018) found negative relation between pasture production and age of household head. Therefore, this suggests age of household head negatively explains rangeland quality. In case of land size, Omollo *et al.* (2018) justified as age of household head is positively influencing pastoralists livelihood resources. Hence, as rangeland is a key resource in the study area, it is expected positively affect size of rangeland.

Education status of household head -is measured as categorical variables: Illiterates (no education), informal education (church/mosque, adult education) and formal education. Labelled as (0 = illiterates; 1 = informal; 2 = formal education). Education is expected to be negatively affected land access and quality of rangeland. The educated person may not follow and respect the customary rule and indigenous practices, and therefore, affect in negative case the rangeland management. In the case of rangeland size, educated person may believe in diversify income (Omollo *et al.*, 2018) and allocate rangeland for hay production for commercial at the expense of grazing land for own livestock. So, expected negatively affect rangeland for livestock.

Livestock holding (TLU) - is continuous variable measured in Tropical Livestock Unit (TLU). Hypothesized as positively and negatively influence size and quality of rangeland, respectively. The one who own more livestock demands large size of rangeland and, therefore positively affect land size (Gemtessa *et al.*, 2005). But more livestock affect rangeland quality as they make pressure on rangeland to some extent. Mohammed *et al.* (2013) found negative correlation of herd size with rangeland improvement.

Training on rangeland management- The variable is dummy (1=yes or 0, otherwise) whether the respondents receive training on rangeland management. In the study area different NGOs provided simple rangeland management practices like bush clearing, identifying, and cutting toxic plants, and systematically firing grasses. So, households who practice these activities may improve their rangelands, and therefore *it is expected to affect rangeland quality positively*. For instance, training pastoralists on rangeland rehabilitation with local knowledge could support rangeland improvement (Liao, 2014).

Findings and Discussions

Demographic and Socioeconomic Characteristics

The findings in Table 1 show the demographic and socioeconomic characteristics based on certain variables,

those considered for the study. Accordingly, the study founds about 97% of household heads were men while the remaining percentage were women led households. The education status of the respondents was poor, that about 95% of households responded illiterate category while no formal education was received at all. The remaining (5%) was informal schooling includes adult education, and Church or Quran.

Age of household head ranged from 25 to 90 years old with on average 66 years with 15.802 standard deviations. However, telling of age with exact years is difficult, because in the study area year count is based on *Gada* age. They Said, "I was born when *Gada* leader was [name]." Then they count by 8 years difference between each leader up to reach the one who is currently leading. This could be created challenges on exact age estimating year. For instance, if they mistakenly add or minus one *Gada* year, about 8 years error will be reported.

Livestock is the basic economic, cultural, and social indicator in the study area (Tolera & Abebe, 2019). Having a large herd size with diverse herd groups is reasonable in Borana pastoral. For instance, cattle are kept for milk and breed and are most preferable in the study area as milk is stable food (Doyo *et al.*, 2018). Goats and camels are preferred for drought resistance as they are browsed grazers, and currently, they are becoming dominant in the study area due to grass shortages (*ibid*). This means that despite cattle rising is preferred by pastoralists, they are forced to raise more camels and goats due to pasture shortage in the study area (*ibid*). For the study, number of livestock was calculated based on Tropical Livestock Unit (TLU) adopted from Bekele (1991) as displayed. Accordingly, the minimum livestock holding unit was about 40 with an average of 288.9 and a high standard deviation (95.91293). Total rangeland allocated for livestock is the outcome variable for the study. Accordingly, the size allocated ranges from 12 to a maximum of 76.24 hectares with an average of 59.54 hectares.

Table 1: Demographic and socioeconomic characteristics of sampled households

Dummy/Categorical Variables					
Gender			N	%	
		Female	11	3.1	
		Male	349	96.9	
		Total	360	100.0	
Education (schooling)		Illiterate	342	95	
		Informal	18	5.0	
		Formal	0	0	
		Total	360	100.0	
Continuous Variables					
	Min	Mean	Max	SD	N
Age	25	66.12	90	15.802	360
Livestock (TLU)	40.4	288.86	663	95.91293	360
Total grazing land (ha)	12	59.54	76.24	26.272432	360
Log of land	1.08	1.6908	1.88	0.31826	360

Source: Survey result (2020)

Status of production systems and land use changes

The findings in Table 2 show the production systems practiced in the study area. Accordingly, two types of production systems have been practiced as a basic livelihood strategy: About 74% of households practiced pastoralism activity while 26% practiced agropastoralism. Concurred to the study result, Mcpeak and Little (2019) found 60% of households practice pastoralism from Borana and Guji zones, where Guji zone is mostly agropastoral participants with mobility being more common in the Borana (ibid). This indicates that Borana pastoralists still strongly practicing pastoralism despite external pressures continuously challenging them for long years.

So, the study suggests due attention from land policy maker to consider pastoralists perception on the newly proposed or imposed land-use changes before further expansion. Indeed, further research is required to identify reasons for sticking to the traditional one. In other case, the study suggests the possibility of relatively simple adjustments to the production system if needed. Concurred to this, Mcpeak and Little (2019) reported as agropastoralists of the study area need to re-join the customary-based communal rangelands holding.

In other explanation, the study justifies participants of the agropastoralism is also on increasing trend, which was 11% by 2000 as reported by Solomon (2007), then 29% as reported by Doyo *et al.* (2018) and is now 26 % (from the findings). This indicates, despite pastoralists have less interest to expand the land-use changes, the Government's objectives are growing into the area. But contrary to the Government plan, most of the agropastoral participants have not shown interest to have legal right for ownership of the land use types (Table 3). This may imply that they might not be happy to follow the land-use changes. However, factors driving them to agropastoralism production system and level of their satisfaction to the production type is not addressed by the current study. So, the study calls further research for identification of deriving factors.

When 26% of agropastoralism is split into the land use types, about 8 % of households are involved in private enclosure whereas about 18 % were in communal enclosure land use type (Table, 2). The study found that households involved in private enclosure were not simultaneously participating in communal enclosure and vis-versa. This finding reflected the study of Mcpeak and Little (2019) who noted that private enclosure and communal enclosure are negatively correlated (trade-off). That means, as participation of household in private enclosure increases, the communal enclosure participation decreased.

Table 2: Production system and land use change across the districts

Districts	Production systems				Total	
	Pastoralism		Agropastoralism		Frequency	%
	Frequency	%	Frequency	%		
Arero	41	79	11	21	52	14
Dirre	47	57	36	43	83	23
Mi'o	18	90	1	5	20	6
Yabello	76	78	22	22	98	27
Taltale	37	66	19	34	56	16
Dillo	48	94	3	6	51	14
Total	268	74	92	26	360	100
Land use changes						
	Private enclosure		Communal enclosure			
Yes	28 (7.8%)		64 (17.8%)			
No	332 (92.2%)		296 (82.2%)			

Source: Survey result (2020)

Table (3) presents the status of land-use regulation in the Borana pastoral area. In the area, land use has no formal system. Everyone can join to the land use type they want and enclose the size they can. But as their livelihood is socially tied and *Gada* system also restricts private enclosure, pastoralists have less interest to practice private enclosure (Mcpeak & Little, 2019).

Accordingly, the study has identified that, despite about 26% of the households involved in agropastoral production nobody has a land certificate for private land ownership (Table, 6). Agreed to the study result, PFE *et al.* (2010) reported, "Land certification has not yet started

in the pastoral areas of Ethiopia because land issues are more complex." (p. 38). However, unlawful landholding system harms resource management and declines the owner's power over their resources (ibid). Therefore, the authors suggested the necessity of a context-based landholding system for sustainable rangeland management. Still, fewer numbers of households are interested to have legal land right for land use types. Concurred to the point, PFE *et al.* (2010) reported, Borana pastoralists are not interested to have individual titled land rights which weakened their traditional system.

Table 3: Rule of land use in the study area

	Yes	
	Frequency	%
Agropastoralism production		
Cultivate crop	92	25.6
Have certificate	0	0
Want certificate	34	37
Who gave permission to use the plot for crop	No body	88
	PA leaders	4
Practice private enclosure	28	8
Have certificate	0	0
Want certificate	11	37.9
Who gave permission to use the plot	No one	28
		100
Practice communal enclosure	64	18
Have certificate	0	0
Want certificate	4	6.3
Who gave permission or make cooperate	Gov't bodies	23
	NGOs	39
	Own group motivation	2
		3.1

Source: Survey result (2020)

To see the implication of the production systems on income contribution, Figure (1) has displayed brief information. It sketches total income from pastoralism and agropastoralism production system. Accordingly, the main income share is from livestock sell and milk sold.

Higher total income is observed from the side of the pastoralism production system even though agropastoralists have participated in more diversified

income sources. The study result agrees with the report of Gemtessa *et al.* (2005) said the destitute households are those largely practice diversified income and have less livestock. In the area, livestock is the main asset that pastoralists directly from it (ibid).

So, the study suggests, encouraging livestock production is the first option for pastoralists' livelihood rather than blindly pushing them to diversified activity at

the cost of livestock production. Similarly, PFE *et al.* (2010) reported, in the study area, participants of agropastoralism production are the poorest. Liao (2014)

also noted as livestock sell is the main income source for the study area as agreed with the study result (Figure, 1).

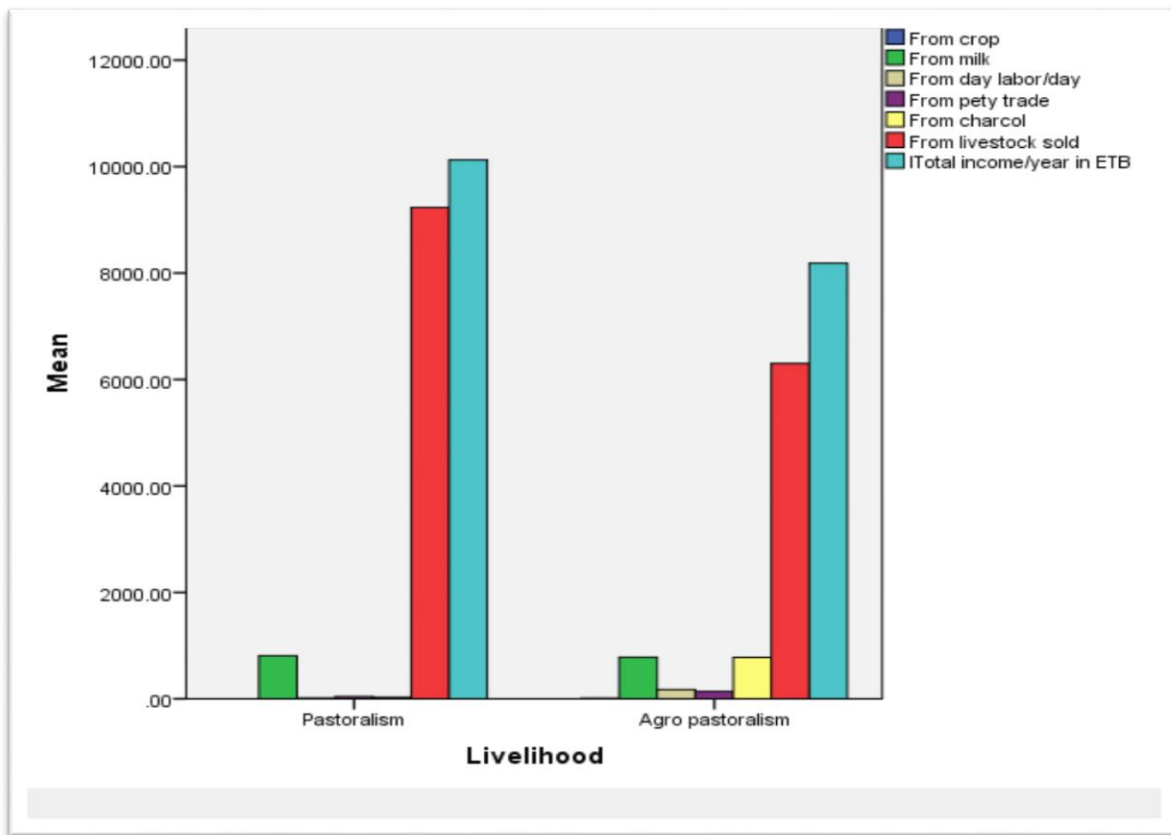


Figure 1: Income source
Sources: Survey result (2020)

Perceptions towards rangeland management result

Table (4) show a response to rangeland evaluation to identify households' perception for the quality of land-use types regarding rangeland management. They give evaluations based on their rangeland output change, relying on different quality indicators. The evaluation categories were 'very poor, poor, good, very good' in a logical order. Accordingly, the result presents most households graded their rangeland as poor (53%), very poor (28%), and good (19%) category. None of the households reported very good grades which are concurred to Tiki, Oba and Tvedt (2011) who reported that only about (2%) of pastoral households gave very good responses for their rangeland quality in the Borana Zone. Solomon *et al.* (2007) conducted a study in Borana zone, and reported, all respondents had responded as rangeland quality is declining over time.

Response for the 'very poor' was viewed from the agropastoralism production system while relatively better in the case of tradition practice. Markus (2013) reported rangeland management which was successful for many

generations, is now extremely degraded from mismanagement. So, the study suggests special attention should be given to prevent undesirable practices. Markus (2013) recommends, improving the livelihood of the pastoralists, socially acceptable and environmentally friendly interventions highly demanded.

Table 4: Rangeland evaluation across land use type and pastoral production

'Yes' responses		Pastoralists (mobility)	Communal enclosure	Private enclosure	Total	
Ordinal Category		Frequency	Frequency	Frequency	Frequency (%)	
	Very poor	26	50	23	99	28%
	Poor	176	12	4	192	53%
	Good	66	2	1	69	19%
	Very good	0	0	0	0	0%
	Total	268	64	28	360	100%

Source: Survey result (2020)

Impact of land use changes on rangeland size

Table (5) displayed estimation results for the impact of land-use types on size of rangeland allocated for livestock. Subsequently, the OLS coefficients under column (II) with control variables and better goodness of fit (95.4 %), and F-test (1894.16; Prob > F = 0.0000) have been reported. R-square indicates the best estimation of the model that the outcome variable is explained by explanatory variables. The overall of F-test value is significant, and indicates the model provides a better fit (i.e. the coefficients are jointly significantly different from zero) ("Regression," 2015). Accordingly, coefficients of OLS result indicates both communal and private enclosures have significantly and negatively affected access of grazing land (Log land), as hypothesized. The one who practices communal enclosure has less access to livestock grazing than the counterpart by about 73 %. Similarly, those involved in the private enclosure have accessed less land for livestock by about 63.5 %. The study of Mcpeak and Little (2019) reported non-mobile households have smaller plots than the mobility practiced. Desta and Coppock (2000) reported a loss of key grazing lands due to cultivation and privatizations are common in the rangeland of the study area. Tiki *et al.* (2011) noted as the expansion of settlements and pasture enclosure affects communal rangeland size negatively.

However, given the environmental condition and pastoralist's lifestyle, pastoralism demands an extensive rangeland grazing system. So, such land-use types that cause shrinkage of rangeland for livestock is not suggested for the study area. So, it might be better if the country's land policies focus on less expansion of communal and private land-use types in the study area.

Among the two land-use types, the magnitude of communal enclosure has more negative consequences than the private enclosure type. The reason might be agreed with Napier and Desta (2011) who reported, in the study area objectives of interventions on communal enclosures subjected to vary. For instance, they reallocate communal enclosure for different purposes like hay production for commercialization and fattening at the expense of pastoralists' livestock feed. Therefore, the study recommends detailed studies and priority attention are needed for communal enclosure land-use type. Also,

the study suggests further evaluation of the interventions' objectives and impacts that have been practiced in the study area.

From the control variables, gender has significantly affected access to grazing land in a positive case as hypothesized. This indicates, being a male-headed household increase land access by about 5.6% more than female-headed households. This may be due to, male households are more experienced in herding practices, and they can go far and participates in large sizes of dheedaa grouping, practice in larger areas of communal enclosure, and enclose larger areas of private enclosure than female.

Table 5: OLS result - Impact of land use types on land access

Variables	I	II	
	Log land	Log land	
Communal enclosure (yes=1)	-0.7380*** (-0.0126)	-0.7314*** (-0.0142)	
Individual enclosure (yes=1)	-0.6449*** (-0.0363)	-0.6350*** (-0.0380)	
Gender (male=1)		0.0567*** (-0.0190)	
Age		0.0002 (-0.0003)	
Education (1=formal)		-0.0118 (-0.0121)	
TLU		0.0000 (0.0000)	
Constant	1.8722*** (-0.0007)	1.7974*** (-0.0299)	
Observations	360	360	
R-squared	0.953	0.954 $F(6, 353) = 1894.16$ $> F = 0.0000$	<i>Prob</i>

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$ Robust standard errors in parentheses
Source: Survey result (2020)

Impact of land use change on rangeland management

Table (6) portrayed the result of the ordinal logit model employed for the evaluation of rangeland management. Before the interpretation of the coefficients, different tests have been run to check the feasibility of the model.

The LR x2 (160.70) for ologit coefficient is significant at ($p < 0.01$) at 95 % level of confidence. This indicates that the ologit regression coefficients of the predictors statistically different from zero. As Liu (2009) suggested, a test of parallel line (proportional odds) assumption should be examined for ordinal logit regression. Accordingly, the *Brant test* result for parallel regression assumption has been tested and confirmed as it couldn't reject the null hypothesis ($p = 0.228$), which indicates the assumption is held (Table, 6).

The outcome category responded by the respondents was three (very poor, poor, good). As the rule of ordinal logit, for 'n' levels of ordinal outcomes, the model makes 'n-1' for predictions (Liu, 2009). Accordingly, the threshold estimates for [cut1] is the cut-off value between very poor and poor, and the threshold estimate for [cut2] represents the cut-off value between poor and good.

Consequently, as the ologit model displayed, both land-use types have significantly affected land quality in negative case as expected. The coefficients (β) of the private enclosure and communal enclosure are -3.72 and -3.49, respectively. The output show that, for households who participate in the private enclosure has the likelihood

of assigning their land quality to the highest category is 3.72 points less than the non-participant. Similarly, households who are involved in communal enclosure land-use type have the likelihood of having the good quality rangeland is 3.49 points less than the counterpart.

Among the two land-use types, the private enclosure has a more negative magnitude than the communal enclosure, contradicting the hypothesized. This may indicate less feasibility of individually managing rangeland even though the private enclosure is expected to be better managed. In the study area, common rangeland management practices are bush clearing, cutting thorny plants, defending other ethnic groups, and mobility between dheedaa fields. So, these management practices may not be better fit at individual level. So, before increasing such land use types, identification of the factors that determine the success of the land-use changes is important.

Table 6: Result of Ordered logistic regression

Variables	Coef.	Std. Err.	Odds Ratio	z	P>z
Private enclosure	-3.72124	0.549656	0.0242039	-6.77	0.000***
Communal enclosure	-3.48699	0.376658	0.0305926	-9.26	0.000***
Age	-0.00368	0.007307	0.99632165	-0.52	0.606
Gender (male=1)	-0.13323	0.820053	0.8752635	-0.16	0.871
Training	0.19518	0.225921	1.215523	0.86	0.388
Education	-0.05839	0.542426	0.9487051	-0.10	0.923
TLU	-0.00014	0.001181	0.9998639	-0.11	0.910
_cut1	-2.53289	1.131476	-2.53289		
_cut2	0.737650	1.121275	0.737650		
Log likelihood = -282.4758			Log pseudolikelihood = -282.48879		
LR chi2(7) = 160.72			Wald chi2(7) = 104.39		
Pseudo R2 = 0.2215			Prob > chi2 = 0.0000***		
Prob > chi2 = 0.0000***			Pseudo R2 = 0.2215		
Number of observations =	360				
Brant	9.364	7		0.228	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
 Source: Survey result (2020)

Conclusions and Recommendations

The study has reviewed, analysed, and identified the status of the production system that the Borana community has relied on. Further, the study has identified the imposed land-use changes and its implication on pastoralism production systems.

Accordingly, the main production systems practiced in the study area are pastoralism and agropastoralism. Pastoralism was largely practiced, and livestock was identified as the main income sources in the study area. This implies despite long year interventions for switching pastoralism to agropastoralism, pastoralists still have followed the traditional one. This implies pastoralism production system is more preferred in the study area. However, trend of the agropastoralism production system is growing even though pastoralists have not expressed much interest to continue with agropastoralism. For instance, as showed from the result, less percent of households has interest to have ownership of land certificate in case of agropastoralism production system.

The agropastoralism production system is the externally imposed production type by the country's pastoral development policy and currently expanded by different NGOs and individuals in the study area. Accordingly, the study identified from 26% of agropastoralists 18 % of households are involved in communal enclosure while 8 % private enclosure grazing system. The study confirmed in the study area expansion of private enclosure is much hated as the community livelihood is socially interconnected and is possible through communal land own. The study has also evaluated rangeland quality based on respondent's perception across land use types. Accordingly, better

response was raised from pastoralists those are practice mobility to maintain rangeland productivity. This indicates poor management result from the land-use types. Finally, regression models were employed to estimate the outcomes variable (access to range land and quality of rangeland) based on land use types. Consequently, both land-use types have significantly affected both outcomes in negative case. Then, based on results the following general recommendations were made: -

First, despite long year interventions, most pastoralists are following the traditional pastoralism production system. Even, from users of the imposed land-use types, most of them are not interested to be confirmed through legal land rights ownership. Indeed, in the study area, the private enclosure has no restriction rule, and everyone encloses the size they can. But a smaller number of the households were following it. This indicates pastoralists are less interested to follow the land use types. So, it is better if the country land policy considers pastoralists' interest in land-use changes before further expanded. However, the current studies couldn't address why more respondents prefer the traditional one while several years of interventions and encouragements continuously raised from Governments and other related stakeholders. So, the study calls for further research on factors of preference.

Second, despite *Gada* system has continuously forbidden the imposed land-use types, the Government has fully-fledged it for livelihood improvement. But the study identified, those who are practicing the land use types have less access to rangeland and less productive rangeland for their livestock. Since access to grazing land and productive rangeland is a key for pastoralism development, threatening of these variables is directly indicates worsening of pastoralists' livelihood. So, before

the expansion of the land use types, the land policymaker is required to understand which production system is more relevant to pastoral land-context and pastoralist's lifestyle like ecological-based, sociocultural context, and economical enterprise.

Third, among of the land use type's average land allocated for livestock under communal enclosure is less. This might be due to the purpose of land enclosures subjected vary, is allocated for renting and grass supply for commercial fattening. So, detail follow up and evaluation is required for relevant intervention of NGOs in the study area. However, regarding rangeland quality, the study depicted that the private enclosure has less quality of land. This may be due to managing rangeland at individual level is not feasible since most common practices in the study area are cutting bush, defending other clans, and moving livestock. So, before imposing such land-use changes, identification of factors that support/hinder the success of the land use type is important.

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