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Targeting highland communal grassland management options

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International Livestock Research Institute (ILRI)

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Contents

Tables

Figures

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Introduction

Farmers living and producing agricultural products in a certain socio-ecological context may be more likely to take up specific management options, while those in other contexts may adopt different options (Coe et al. 2014). Generally, uptake or adoption of agricultural management options depends on their effectiveness in a specific agro-ecological context, the apparency or observability of benefits, and concerns over cost and risks (Hartmann and Linn 2008, Hermans et al. 2021). To better understand which contexts may have greater adoption, it is valuable to compare adoption of management options or practices in different contexts. This comparison can reveal how the perceived relative effectiveness and feasibility of each management option in a specific context, and how relative effectiveness and feasibility varies between different contexts.

This guide presents information useful in targeting management to the contexts of communal grasslands in the highlands of Ethiopia. The options considered here include techniques for grazing management and intensive restoration in communal grasslands. This targeting guideline serves as a supplement to an implementation guide (Sircely and Eba in press) that describes the larger process of management planning for highland communal grasslands. These materials are designed to be used by government officers and civil society practitioners engaged in supporting communal grassland user groups in the Ethiopian highlands to improve management of their grasslands. These government and non-governmental organization (NGO) staff act as facilitators of user groups to improve management of their communal grasslands according to the interests and livelihood goals of each user group. In other words, the user group decides what goes into the management plan, while the facilitators help the group to achieve this goal. The end result is a management plan that is credible in the eyes of the user group, that is more likely to be sustainable in the long term, and can successfully improve farmer livelihoods and enhance the delivery of ecosystem services from communal grasslands across the Ethiopian highlands.

The contexts of highland communal grasslands vary greatly, even at local level (Benin and Pender 2002, Eba and Sircely 2020a). Differences in context include the size of the grasslands, emphasis of livelihoods on livestock versus crops or a mix of the two, contribution of communal grasslands to the ‘feed basket’ for livestock, market access, and the relative orientation of farmers between markets and household consumption in production goals. These and other contextual factors can influence the management options selected by communal grassland user groups. For example, smaller grasslands might be managed in a more detailed manner; good market access and market-oriented production could incentivize greater financial investments; and reliance of farmers on livestock and livestock products for their livelihoods could motivate collective action and investment into communal grasslands.

The overall process of planning highland communal grassland management (Sircely and Eba in press) begins with a first stage of characterization of management systems in a particular highland area, such as a woreda or zone, which provides a large set of variables that can be used to describe communal grassland contexts (Eba and Sircely 2020a). The second stage involves prioritization of management objectives for communal grassland user groups, which also includes an initial assessment of possible management options (Eba and Sircely 2020b). These steps are accomplished through brief focus group discussions. In the third and final stage, a management planning workshop is held with each individual communal grassland user group to create a management plan (Sircely and Eba in press). The final outcome of this process are communal grassland management plans, that are created to serve the interest and goals of each user group. The plans include both technical management practices and institutional means by which the user group will implement and enforce the plan. Management plans are translated by facilitators into the local language of the area, are deposited with woreda (district) and and copies are distributed to the kebele (sub-district) government and retained by the user group. An example of a management plan created through this process, in Amharic and English, is available in Appendix B of the implementation guide (Sircely and Eba in press).

The techniques for grazing management and intensive restoration in communal grasslands considered during management planning were derived from the published literature and implementation experience. Grazing management options included rotational grazing (Butterfield et al. 2006), a well-known set of practices. Basic seasonal grazing divides a grassland into portions used during different seasons, as inspired in part by traditional pastoralist management systems (Oba 2012). 'Short-resting' or 'spelling' of portions of a grassland for limited periods of time (Sircely et al. in press, Ash et al. 2011) was the simplest and least costly grazing management option. Intensive restoration options included reseeding, gully rehabilitation, trenches for soil and water conservation (Desta et al. 2005), removal of problematic vegetation such as weeds and invasive species (Negasa et al. 2014), and grazing exclosure enriched with improved forages and/or fodder shrubs and trees (Sircely et al. in press).

The full process of highland communal grassland management (HCGM) was piloted with 10 communal grassland user groups in the Menz area of Amhara, known for its Menz breed of sheep (Sircely and Eba in press). Here, quantitative analysis was applied to reveal patterns of adoption and support for grassland management options, and how adoption and support for these management options varied among the contexts of user groups. These data can help practitioners target management options to communal grassland contexts where they are more likely to be suitable, adopted, and ultimately successfully improve feed availability, farmer livelihoods and ecosystem services provided by communal grasslands in the Ethiopian highlands.

Adoption and feasibility of management options in highland communal grasslands

Adoption of management options was defined as being included in the formal management plans for communal grassland user groups (Sircely and Eba in press). Adoption of grazing management options was significant (Table 1), with 9 out of 10 user groups adopting both short-resting and basic seasonal grazing. The 1 grassland that did not adopt either option is a large, multi-kebele grassland with many users and some level of dispute over resource access; this makes grazing management difficult.

Table 1. Adoption of grazing management options

Grassland area (ha)	Number of households in user group	Number of villages using	Certified (yes/no)	Main livelihood focus	Priority livestock species	Short-resting	Basic seasonal grazing	Rotational grazing	Number of grazing management options planned
2	18	1	No	Crops	Sheep	✓	✓	—	2
2.5	17	1	Yes	Mixed	Sheep	✓	✓	—	2
3	15	1	No	Crops	Cattle	✓	✓	—	2
4	41	1	No	Crops	Sheep	✓	✓	—	2
4	21	1	No	Crops	Sheep	✓	✓	—	2
4	10	1	No	Mixed	Cattle	✓	✓	—	2
6	42	2	Yes	Mixed	Cattle	✓	✓	—	2
25	100	Many	No	Livestock	Cattle	—	—	—	0
75	400	Many	No	Livestock	Sheep	✓	✓	—	2
200	600	Many	No	Livestock	Sheep	✓	✓	—	2
					Total:	9	9	0	

Rotational grazing was not adopted by any user groups, indicating that it is not feasible for these user groups at the present time (though it could be feasible for them in the future, or for different groups). Since most user groups adopted both short-resting and basic seasonal grazing, on average user groups adopted around 2 grazing management options (Table 3).

Adoption of intensive restoration options was lower and more variable (Table 2) than grazing management. Reseeding and removal of weeds and invasive species were each adopted by 1 user group. Trenches were adopted by 2 user groups, while 1 group adopted enriched exclosure. As most options were adopted by different groups, each of whom selected 1–2 options, on average user groups adopted around 0.5 intensive restoration options (Table 3).

Table 2. Adoption of intensive restoration options

Grassland area (ha)	Households in user group	Number of villages using	Certified (yes/no)	Main livelihood focus	Priority livestock species	Reseeding	Gully rehab.	Removal of weeds, invasives	Trenches	Enriched exclosure	Intensive restoration options planned
2	18	1	No	Crops	Sheep	—	—	—	—	—	0
2.5	17	1	Yes	Mixed	Sheep	—	—	—	—	—	0
3	15	1	No	Crops	Cattle	—	—	—	—	—	0
4	41	1	No	Crops	Sheep	—	—	—	✓	—	1
4	21	1	No	Crops	Sheep	—	—	—	—	—	0
4	10	1	No	Mixed	Cattle	—	—	—	—	—	0
6	42	2	Yes	Mixed	Cattle	—	—	—	✓	—	1
25	100	Many	No	Livestock	Cattle	✓	—	✓	—	—	2
75	400	Many	No	Livestock	Sheep	—	—	—	—	—	0
200	600	Many	No	Livestock	Sheep	—	—	—	—	✓	1
					Total:	1	0	1	2	1	

Table 3. Overall feasibility of communal grassland management options, based on stated and revealed preferences of communal grassland user groups

	Stage of process:	Prioritiz-ation	Management planning (beginning)	Management planning (end)		
Option type	Option	Selected (number of grasslands)	Ranked (number of grasslands)	Adopted (number of grasslands)	Addition/ Attrition rate (net change)	Feasibility score (% change)
Grazing management options	Short-resting	6	8	9	3	50
	Basic seasonal grazing	9	10	9	0	0
	Rotational grazing	8	0	0	-8	-100
	Mean grazing options	2.3	1.8	1.8	-0.5	-22
Intensive restoration options	Reseeding	4	1	1	-3	-75
	Gully rehabilitation	4	0	0	-4	-100
	Invasive species removal	1	1	1	0	0
	Trenches*		5	2	-3	-60
	Enriched exclosure*		3	1	-2	-67
	Mean intensive options	0.9	1	0.5	-0.4	-44
	Mean total options	3.2	2.8	2.3	-0.9	-28

* Trenches and enriched exclosure were not mentioned or asked about during prioritization of management objectives

The relative feasibility of management options was assessed by tracking support for each throughout the HCGM process—from initial selection during the management objectives prioritization stage, to rankings made at the beginning of the management planning workshop, and finally to adoption in the management plan at the end of the workshop. Net change in the number of grassland user groups supporting each option at these three points in the process can be used to gauge the influence of initial ideas, discussions and reflections on final adoption.

Net change in support was measured first in terms of the 'addition/attrition rate' (acceptance vs. de-selection) of management options throughout the process (Table 3). This rate serves as an indicator of the general relevance and feasibility of options. Second, the percentage change in support for management options provides a 'feasibility score', an indicator of the relative general feasibility of options that can be used to compare addition/attrition across geographic locations. Positive addition/attrition rates and feasibility scores indicate relatively higher feasibility of management options from the perspective of farmers, as new user groups decided to adopt them. Negative addition/attrition rates and feasibility scores indicate lower feasibility of management options, as user groups increasingly dismissed them as the management plan took shape. Addition/attrition rates and feasibility scores of zero indicate consistent relevance and feasibility.

On average, addition/attrition rates and feasibility scores were higher for grazing management options than for intensive restoration options (Table 3), as seen for adoption rates. Rotational grazing was an exception, as it had the lowest addition/attrition rate and feasibility score of all management options considered, even when using the extremely simplified approach (Sircely and Eba 2020) of planning rotations based on grazing and resting periods (Butterfield et al. 2006). In contrast, short-resting had the highest addition/attrition rate and feasibility score among all management options, and both short-resting and basic seasonal grazing were much more relevant and feasible than rotational grazing. Overall, short-resting was the most relevant and feasible grazing management option, closely followed by basic seasonal grazing. Rotational grazing was the least relevant and feasible grazing management option.

Among intensive restoration options, removal of weeds and invasive species had the highest addition/attrition rate and feasibility score. Trenches, reseeding and enriched exclosure registered lower addition/attrition and feasibility. Gully rehabilitation had the lowest addition/attrition rate and feasibility score among the intensive restoration options. According to these rankings, removal of weedy and invasive species was most feasible, followed by trenches (but note that trenches had the highest actual adoption of intensive options in 2 grasslands; Table 2), and reseeding; finally, gully rehabilitation was least feasible.

Influence of context on adoption and feasibility of communal grassland management options

The general adoption and feasibility of communal grassland management options (Tables 1, 2, and 3) provide general expectations for any communal grassland in the highlands. To move toward targeting specific management options to specific contexts of communal grasslands, the adoption and feasibility of management options was compared across gradients in several potentially important contextual variables.

The context of communal grassland user groups was quantified using a large set of indicators (Eba and Sircely 2020a). The contextual variables proposed as most important to adoption and feasibility of communal grassland management options were:

- Market access (shorter walking time to the nearest market);
- Livestock reliance for livelihoods (% of the user group who ranked livestock over crops as their primary source of livelihood);
- Livestock holdings (mean tropical livestock units (TLUs) of user group households);
- Grassland size (ha); and
- Reliance on the communal grassland for livestock feed (% of the total livestock feed basket for the user group).

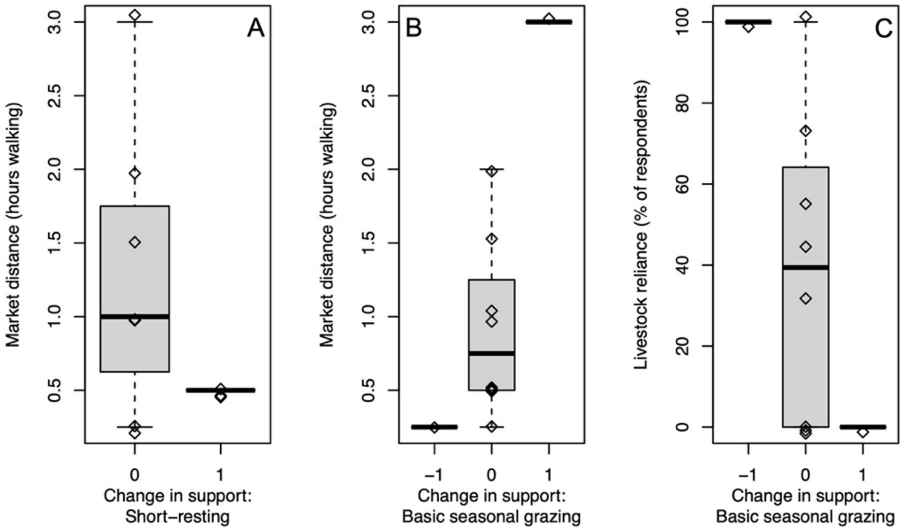
These are not all of the contextual variables collected, yet some indicators such as number of households in the user group or number of villages using the grassland (Tables 1 and 2) were closely correlated with grassland size, and would not provide additional information. Other contextual variables were highly variable, or did not vary at all, and patterns of adoption with these contextual factors could not be observed from the Menz dataset. Government certification of communal grassland user rights to user groups (Tables 1 and 2), for example, could not be used in contextual analyses since only 2 of the 10 grasslands had been certified to date under the ongoing certification process.

As for general adoption and feasibility, two indicators were used to track the uptake and feasibility of communal grassland management options in relation to context. Again, adoption was defined as being included in documented management plans for communal grassland user groups (Sircely and Eba in press) in a certain context. Second, net change in support for management options for each individual grassland—from initial interest during prioritization of management objective, to rankings at the beginning of the management planning workshop, to adoption in management plans—was used to assess whether and how the feasibility of options varies with context. A positive net change in support for a management option associated with a certain contextual variable indicates relatively higher feasibility in that context. Options with no change indicate that context did not influence feasibility. Options with a negative net change in support associated with a certain contextual variable indicates relatively lower feasibility in that context. That is, net change in support indicates what contextual factors may have influenced user groups to change their minds and decide to adopt a management option they did not previously support, or decline a management option they had previously supported. The small study sample of 10 communal grasslands in Menz points to apparent trends that might be useful elsewhere in the Ethiopian highlands. However, some of these trends may differ significantly among various areas in the highlands.

The average number of total management options adopted by communal grassland user groups which was consistently around 2 options per user group, was similar across different contexts, and did not vary with contextual factors. Similarly, adoption of grazing management options did not vary with contextual factors, since 9 out of the 10 user groups adopted both short-resting and basic seasonal grazing. Since adoption of grazing management options was high and varied little among grasslands, these options were seen as relevant and effective by user groups. Like adoption, net change in the total number of management options supported (from selection of options during prioritization of management objectives, to ranking at the beginning of management planning, and finally adoption in management plans) and the number of grazing management options supported did not vary with grassland contexts.

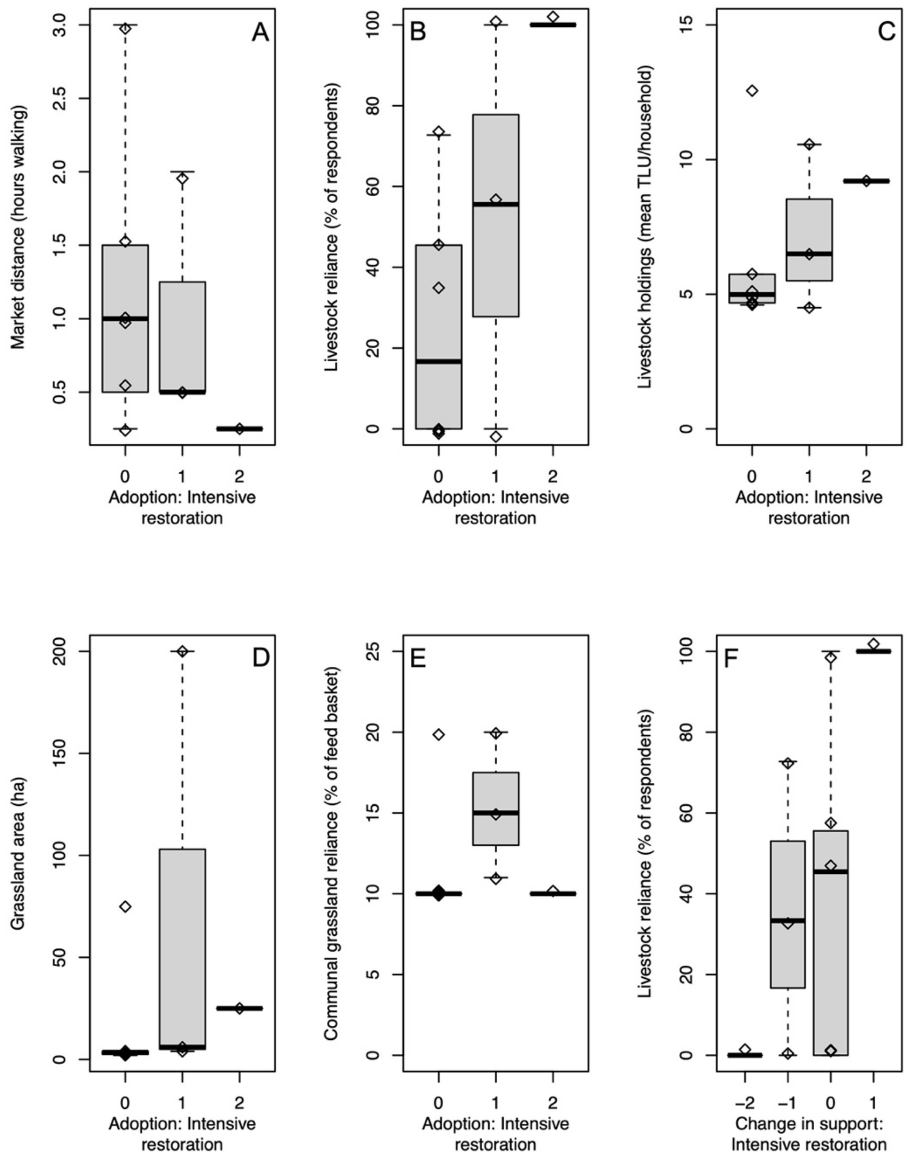
For grazing management options, little variation in adoption and net change in support made it difficult to attribute adoption and feasibility to context. Short-resting and basic seasonal grazing did not show any differences in adoption with context, but did exhibit some contextual trends with net change. Support for short-resting increased in 3 grasslands, all of which had better market access, considering that all 3 were approximately 30-minutes' walk from the nearest market (Figure 1A). In contrast, support for basic seasonal grazing (Figure 1B) increased in 1 grassland with poor market access (3 hours from nearest market), and decreased in 1 grassland with good market access (15 minutes). Support for basic seasonal grazing decreased in 1 grassland with high livestock reliance (Figure 1C), and increased in 1 grassland with low livestock reliance. However, the 1 grassland that decided against basic seasonal grazing is a multi-*kebele* grassland where grazing is difficult to control, which poses a strong challenge for any improvement in grassland management.

Figure 1. Change in support for grazing management options with contextual variables. Due to the data distribution, statistics were not applied. Points are jittered slightly for greater clarity.



For intensive restoration options, greater variation in adoption and net change in support allowed for easier linking to contextual variables. The number of intensive restoration options adopted tended to be higher in grasslands with better market access (Figure 2A), with greater livestock reliance (Figure 2B), higher livestock holdings (Figure 2C), and larger area (Figure 2D). Of these contextual variables, adoption of a greater number of intensive restoration options was most closely associated with higher livestock reliance. Livestock reliance was associated with change in the number of intensive restoration options supported (Figure 2F), since user groups with lower livestock reliance tended to be more likely to change their minds and decide to implement fewer intensive restoration options, while 1 highly livestock-reliant user group increased the number of intensive options. Since there was more variation in adoption and net change in support among different intensive restoration options, trends for individual intensive restoration options reveal more detailed information.

Figure 2. Number of intensive restoration options adopted with contextual variables, and change in the number of intensive restoration options supported with contextual variables. Due to the data distribution, statistics were not applied. Points are jittered slightly for greater clarity.



Trenches dug for soil and water conservation were adopted in only 2 of the 10 grasslands. These 2 grasslands adopting trenches had lower household livestock holdings (Figure 3A), and were among the smaller grasslands (Figure 3B) with area of < 2 ha. Net change in support for trenches decreased in 3 grasslands, 2 of which relied most on the communal grassland for feed (Figure 4E), indicating relatively low feasibility where the communal grassland is an important source of livestock feed. These 2 user groups highly reliant on communal grasslands also had higher livestock holdings (Figure 4C), and larger grasslands (Figure 4D). The 3 grasslands that reduced their support for trenches tended to have better market access (Figure 4A), and were more reliant on livestock for their livelihoods (Figure 4B), although these patterns were weaker.

Figure 3. Adoption of trenches with contextual variables. Due to the data distribution, statistics were not applied. Points are jittered slightly for greater clarity.

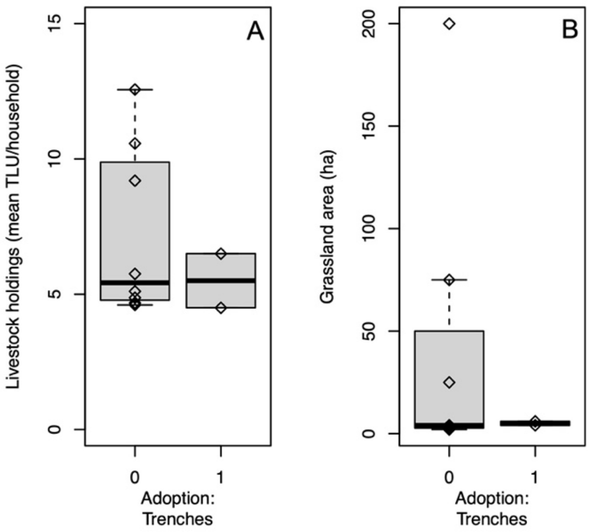
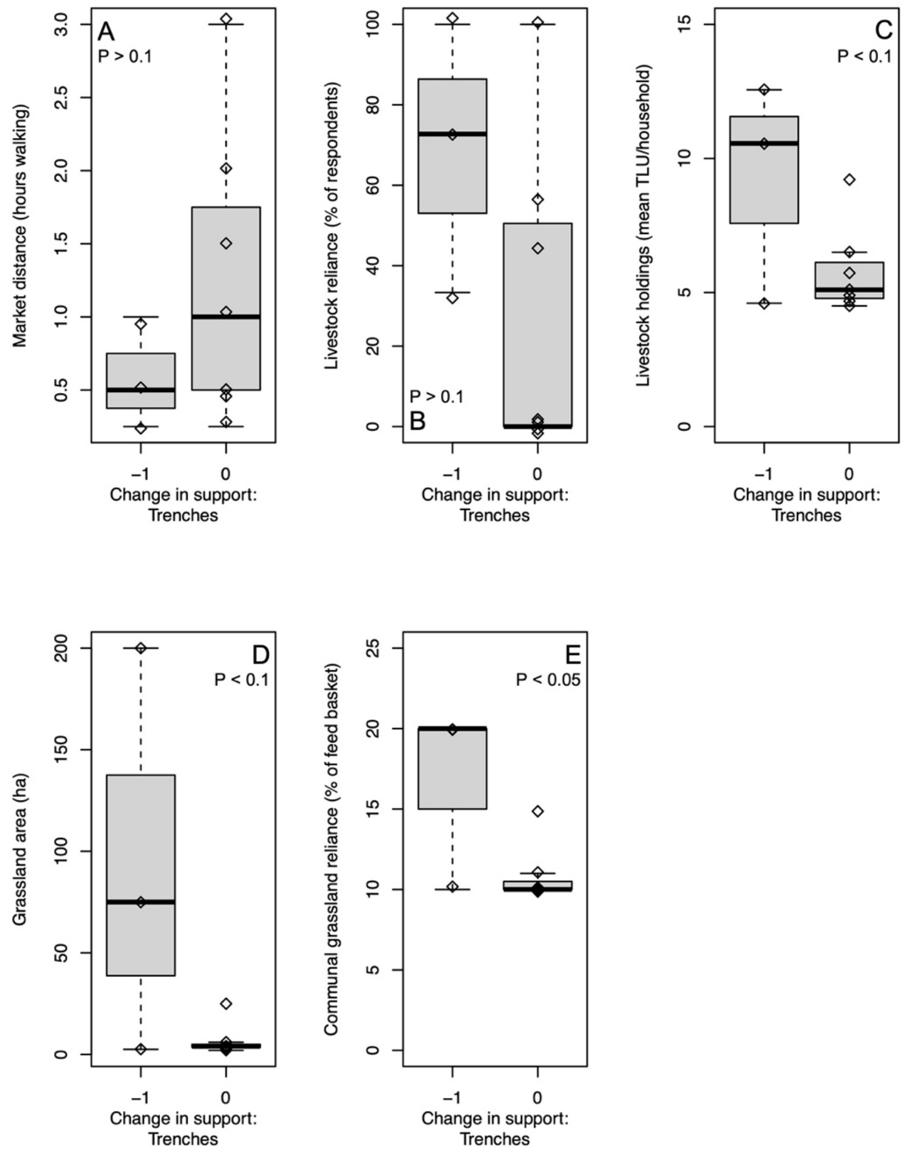
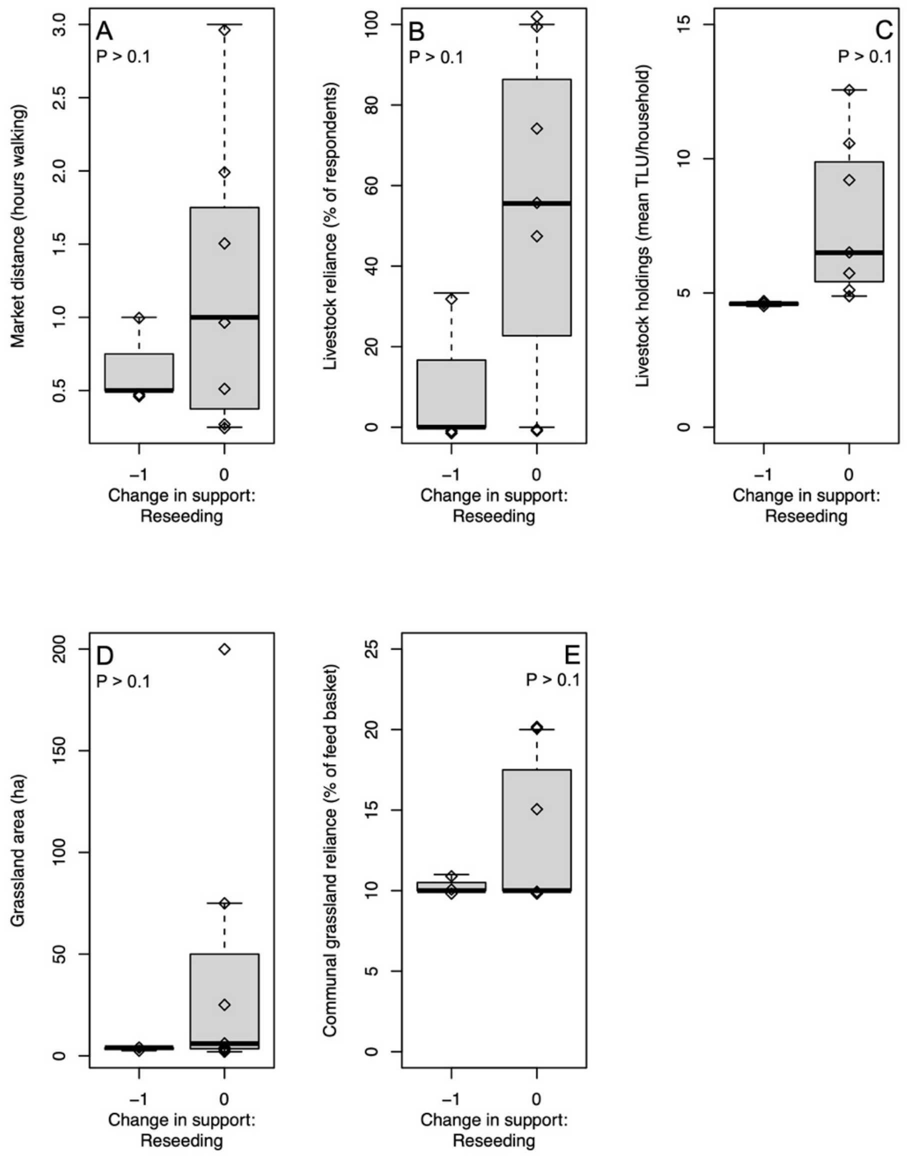


Figure 4. Change in support for trenches with contextual variables. Statistics reported are from analysis of variance (ANOVA). Grassland area was ln-transformed prior to analysis. Points are jittered slightly for greater clarity.



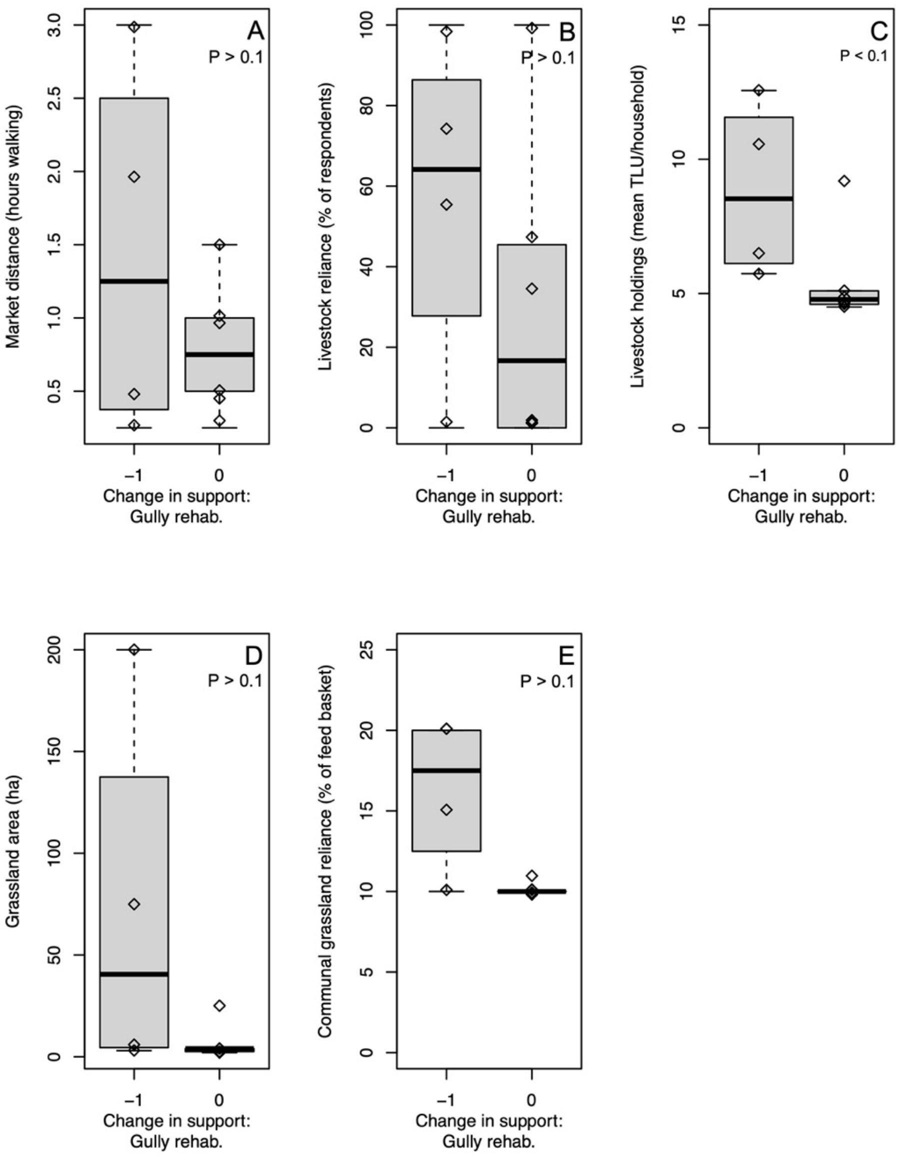
Reseeding was adopted in 2 grasslands. However, these grasslands had very different contexts, meaning that adoption was not associated with any contextual variables. Net change in support for reseeding decreased in 3 grasslands that tended to have better market access (Figure 5A), lower livestock reliance (Figure 5B), low livestock holdings (Figure 5C), small grasslands (Figure 5D), and lower reliance on communal grasslands (Figure 5E). However, none of these trends were strong.

Figure 5. Change in support for reseeding with contextual variables. Statistics reported are from analysis of variance (ANOVA). Grassland area was ln-transformed prior to analysis. Points are jittered slightly for greater clarity.



Gully rehabilitation was not adopted by any grassland user group, and this lack of adoption had no relation to context. Support for gully rehabilitation decreased in grasslands with high feed reliance on the communal grassland (Figure 6E), and these user groups also had higher livestock holdings (Figure 6C). Support for gully rehabilitation tended to decrease in grasslands with higher reliance on livestock (Figure 6B). Half of these user groups also had larger grasslands (Figure 6D) and better market access (Figure 6A).

Figure 6. Change in support for gully rehabilitation with contextual variables. Statistics reported are from analysis of variance (ANOVA). Grassland area was ln-transformed prior to analysis. Points are jittered slightly for greater clarity.



Using communal grassland contexts to target management options

Imagine that you are supporting the user group of a communal grassland in the highlands to improve the management of their grassland. Any management option can be potentially successful in any communal grassland—if the user group has the interest, capacity and will to implement a management option, they are likely to successfully improve feed availability and the condition of their grassland. However, targeting of management options may help the user group to plan their management. As the facilitator of management planning, you have the roles of introducing new ideas, and challenging the user group to vet their ideas, to finally create a realistic, effective management plan. Which management options are most likely to be effective and feasible for this user group, and more likely to be adopted? Which options will probably not be adopted in this grassland, due to lower effectiveness or lower feasibility? Management options that are most likely to succeed should be suggested and emphasized in discussions.

The following guide and tables (Tables 4 and 5) can be used as a general targeting guideline. Combining the data on adoption of management options, and change in support for management options, provides two lines of evidence to identify which management options may be most suitable in which contexts.

Context: Market access (shorter walking time to nearest market, in hours)

Grazing management options. Since short-resting and basic seasonal grazing were widely adopted (Table 1), both options were suitable in a wide variety of contexts. In grasslands with better or poorer market access, both short-resting and basic seasonal grazing were suitable (and rotational grazing may be suitable in grasslands with better organized or more motivated user groups). In grasslands with better market access, short-resting was more suitable, while in grasslands with poorer market access basic seasonal grazing was more suitable (Table 4).

Table 4. Suitability of grazing management options in highland communal grassland contexts.

Context variables and relative values (units)		Grazing management options		
		Short-resting	Basic seasonal grazing	Rotational grazing
Market access	High	✓✓✓	✓✓	–
(shorter distance to nearest market)	Low	✓✓	✓✓✓	–
Livestock reliance	High	✓✓	✓✓	–
(% relying on livestock over crops)	Low	✓✓	✓✓✓	–
Livestock holdings	High	✓✓	✓✓	–
(mean TLU/household)	Low	✓✓	✓✓	–
Grassland size	High	✓✓	✓✓	–
(ha)	Low	✓✓	✓✓	–
Reliance on communal grassland	High	✓✓	✓✓	–
(% of total feed basket)	Low	✓✓	✓✓	–

Option fit to context:
✓✓✓ Very suitable
✓✓ Suitable
✓ Somewhat suitable
– Less suitable

Intensive restoration options. In grasslands with better market access, a greater number of intensive restoration options tended to be adopted (Figure 2). However, each option showed different suitability patterns. In grasslands with better market access, gully rehabilitation was somewhat suitable, and reseeding and trenches were less suitable (Table 5). In grasslands with poorer market access, reseeding and trenches were somewhat suitable, and gully rehabilitation was less suitable (Table 5).

Table 5. Suitability of intensive restoration options in highland communal grassland contexts.

Context variables and relative values (units)		Intensive restoration options				
		Reseeding	Gully rehabili-tation	Trenches	Invasive species removal	Enriched exclosure
Market access	High	–	✓	–	ND	ND
(shorter distance to nearest market)	Low	✓	–	✓	ND	ND
Livestock reliance	High	✓	–	–	ND	ND
(% relying on livestock over crops)	Low	–	✓	✓	ND	ND
Livestock holdings	High	✓	–	–	ND	ND
(mean TLU/household)	Low	–	✓	✓✓	ND	ND
Grassland size	High	✓	–	–	ND	ND
(ha)	Low	–	✓	✓✓	ND	ND
Reliance on communal grassland	High	✓	–	–	ND	ND
(% of total feed basket)	Low	–	✓	✓✓✓	ND	ND

Option fit to context:
✓✓✓ Very suitable
✓✓ Suitable
✓ Somewhat suitable
– Less suitable
ND No data

Context: Livestock reliance for livelihoods (% of the user group who ranked livestock over crops as their primary source of livelihoods)

Grazing management options. In grasslands with higher or lower livestock reliance for livelihoods, both short-resting and basic seasonal grazing were suitable (Table 4). In grasslands with higher livestock reliance, basic seasonal grazing was more suitable, while it was less suitable in grasslands with lower livestock reliance (Table 4).

Intensive restoration options. Grasslands with higher livestock reliance for livelihoods adopted a slightly higher number of intensive restoration options (Figure 2). In grasslands with higher livestock reliance, reseeding was somewhat suitable, and gully rehabilitation and trenches less suitable. In grasslands with lower livestock reliance, gully rehabilitation and trenches were somewhat suitable, while reseeding was less suitable (Table 5).

Context: Livestock holdings (mean tropical livestock units (TLUs) of user group households)

Grazing management options. In grasslands with high or low average household livestock holdings, both short-resting and basic seasonal grazing were suitable (Table 4).

Intensive restoration options. Grasslands with higher average household livestock holdings tended to adopt a slightly higher number of intensive restoration options (Figure 2). Adoption and support for intensive restoration options was similar for livestock holdings and reliance on livestock for livelihoods, because these two variables are closely related. In grasslands with higher livestock holdings, reseeding was somewhat suitable, and gully rehabilitation and trenches were less suitable (Table 5). In grasslands with lower livestock holdings, trenches were more suitable, gully rehabilitation was somewhat suitable, while reseeding was less suitable (Table 5).

Context: Grassland size (ha)

Grazing management options. In larger and smaller grasslands, both short-resting and basic seasonal grazing were suitable (Table 4).

Intensive restoration options. Larger grasslands tended to adopt a slightly higher number of intensive restoration options (Figure 2). In larger grasslands, reseeding was somewhat suitable, while gully rehabilitation and trenches were less suitable (Table 5). In smaller grasslands, trenches were more suitable, gully rehabilitation was somewhat suitable and reseeding less suitable (Table 5).

Context: Reliance on the communal grassland for livestock feed (% of the total feed basket for the user group)

Grazing management options. In grasslands with higher or lower reliance on the communal grassland for livestock feed, both short-resting and basic seasonal grazing were suitable (Table 4).

Intensive restoration options. In grasslands with higher reliance on the communal grassland for livestock feed, reseeding was somewhat suitable, and gully rehabilitation and trenches less suitable (Table 5). In grasslands with lower reliance on the communal grassland for livestock feed, trenches were more suitable, gully rehabilitation somewhat suitable, while reseeding was less suitable (Table 5).

Conclusion

All of the management options considered here may be potentially suitable in any communal grassland context. The capacity, interest, and will of the user group are the ultimate determinants of successful collective action to improve grassland management. However, management plans also need to be realistic and feasible to successfully improve feed availability and grassland condition. Plans will likely need to be more sophisticated to implement more costly options such as rotational grazing and gully rehabilitation.

Adoption and support for short-resting and basic seasonal grazing demonstrated the willingness of communal grassland user groups to implement simpler, less costly approaches to grazing management. The increase in support for short-resting in grasslands with better market access suggested that some user groups close to markets were interested in more advanced management. However, perhaps due to management constraints, these groups opted for short-resting as a simple, low-cost technique. In contrast, the increase in support for basic seasonal grazing in 1 grassland with poor market access (3 hours from nearest market), and the decrease in support in 1 grassland with good market access (15 minutes) indicates that basic seasonal grazing (and perhaps more organized grazing management in general) is more suitable for communal grasslands that have poorer market access.

In comparison to short-resting, basic seasonal grazing requires stronger collective action, which has been documented as more likely in areas far from markets in Amhara (Benin and Pender 2002). Meanwhile, the decrease in support for basic seasonal grazing in 1 grassland with high livestock reliance, and the increase in support in 1 grassland with low livestock reliance, could be meaningful. Reduced support for seasonal grazing might indicate that farmers who rely more on livestock are reluctant to implement grazing management. Grazing management controls always restrict pasture access somewhat, which is a cost to farmers, but a cost that must be paid if the grassland is to continue remaining productive or its productivity is to increase. Alternatively, enhanced support for seasonal grazing could indicate that farmers who rely more on crops than on livestock for their livelihoods might value the grassland as pasture for oxen used for plowing.

Adoption and support for intensive restoration options was lower than for grazing management options, yet there was significant interest in active rehabilitation of communal grasslands. The number of intensive restoration options adopted tended to be higher in grasslands with better market access, greater livestock reliance, higher livestock holdings and a larger area. The number of intensive restoration options adopted was highest in grasslands where farmers rely more heavily on livestock. In these grasslands, an increase in the number of intensive restoration options supported was also more likely. These overall trends in adoption and change in support for intensive restoration options suggest potential roles of livestock, market access and market-oriented agricultural production in motivating and actioning intensive restoration of communal grasslands (Amare et al. 2017). The user groups who changed their minds to decide against gully rehabilitation were different from those who decided against trenches; both of whom were also different from those user groups who decided against reseeding. This pattern shows that communal grassland user groups viewed each intensive restoration option differently, and these views may be influenced by context.

The trends in adoption and change in support for trenches indicated that for communal grassland user groups who rely heavily on communal grasslands for feed, and are more specialized in livestock production, trenches were less valuable and less feasible. The tendency of those with better market access to withdraw their support for trenches might indicate a lack of confidence that trenches will provide quick, tangible returns. However, this trend was weak and could result from other factors. Adoption and change in support for reseeding showed only weak trends with contextual variables. For gully rehabilitation, change in support indicated greater feasibility in communal grasslands that farmers depend on heavily for livestock feed, and perhaps also in grasslands with higher livestock ownership and reliance on livestock for livelihoods. However, these grasslands also tended to be larger, and to have poorer market access, suggesting that a higher likelihood of collective action in areas far from markets (Benin and Pender 2002) could be responsible for these trends. Gully rehabilitation is important to protect against the loss of productive land. However, it is costly in terms of labor. Coordination of labor for collective action is a significant constraint, which some user groups may be able to overcome. In the communal grasslands of Menz,, however no user groups adopted gully rehabilitation, perhaps on account of these constraints.

An element of context that varies with climate and management systems across geographic regions of the highlands are the time periods when resting can be feasibly conducted. Under short-resting and basic seasonal grazing, periods of rest from grazing need to be planned when resting is ecologically beneficial (i.e., when growing conditions are present) but also when resting is feasible for farmers. It is important to ask farmers in what periods of the year alternative grazing sources are available, v not available. Generally, periods with few alternative sources will conform to periods of forage scarcity. In the Ethiopian highlands, the main periods of forage scarcity are generally during the middle of the *kiremt* main rainy season, and at the end of the dry season. Periods when alternative feed sources are available include times of year when crop residues or cut-and-carry fodders can be fed to animals, or when farmers can access other grazing lands. In Menz, the most feasible time for resting was toward the end of the rainy season, from around July to September. At this time, portions of individual plots are typically used for grazing, which allows feasible resting of communal grasslands under short-resting or basic seasonal grazing. This end-of-season rest strategy is being tested in action research trials in Menz (Eba and Sircely *in press*). Some user groups indicated that other feasible resting periods in Menz include the *belg* early rains season, the dry season (but note that dry-season rest is less beneficial), and even during the main *kiremt* rainy season in some cases.

To improve targeting of management options to communal grassland contexts, data from many sites would improve predictive ability and enable creation of quantitative targeting models. The current data was insufficient to create farmer topologies, and comes from a limited area (Menz). Still, grouping farmers into topologies often makes sense theoretically, but can be coarse when it comes to predicting management practice (Nyambo et al. 2019). For this reason, farmer typologies may be equally effective in characterizing context as using gradients in contextual factors that observed data have shown to be significant. Regardless of the methods used to characterize context, greater replication will improve predictive power in targeting. This observation is especially true for more variable elements of context, such as farmer prioritization of specific livestock types and their production purpose (e.g., oxen), for which more replication would ease linking of management options to this important element of context. Replication across larger areas of the highlands with their differing contexts, especially agro-climatic zones and, as we have seen here, market access, would be particularly useful in developing predictive targeting approaches.

Targeting management options to communal grassland contexts can help identify which options are likely to work best, where, and for whom. Targeting information can be used in deciding which management options to emphasize or *de*-emphasize during user group planning discussions, and which options may require more detailed planning in terms of technical planning and institutional oversight. Supporting communal grassland user groups to improve management can significantly improve feed availability, bolster the livelihoods of farmers, and the sustainable delivery of ecosystem services from communal grasslands across the Ethiopian highlands.

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