

Rehabilitating benefits and its sustainability of a degraded semi-arid Rangeland in Yabello Southern Ethiopia

Abstract

Rehabilitating the degraded rangeland in Ethiopia is very crucial issue for improving the livelihood of pastoralist life style and the environmental sustainability of the country. In Yabello rangeland area the local communities used enclosure method in order to rehabilitate the degraded rangeland area and try to address their livelihood problems. In general the current study tried to assess the benefits obtained from the rehabilitated rangeland area from the three study site chosen through purposively techniques based on the information gathered from different aspect. Semi- structured interview, Focal group discussion was held with key informants and different stakeholders at each kebele level have been conducted to gather information from the total of 150 respondents (50 from each kebele) and analyzed both in qualitative and quantitative approaches. The result showed that the rehabilitated rangeland area mainly used to get both numerical and non-numerical benefits like livestock fattening, grazing purpose, wood cutting and charcoal production and among this livestock fattening is the major source of income across the whole study site and Dida Tuyura (A1) is the most productive site among the rest. From this we recommend that there is a need to enhance market linkages for restored rangeland products that would then drive the adoption of rangeland restoration initiatives and those helps for sustainable utilization of the rehabilitated.

Keywords: rehabilitation, yabello, degraded rangeland, benefits, sustainability

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Introduction

Rangeland degradation in the semi-arid rangeland of Yabello is a well-known and challenging problem for pastoralists.¹ Both climatic and anthropogenic factors are the major rangeland degradation process simultaneously takes away the capacity of the land to provide regulating, socio-cultural and supporting services.² A few decades ago, the Yabello rangelands in southern Ethiopia were considered amongst the best grazing lands in east Africa.³ Because of the global climate change and the intensive human activities, desertification/land degradation has become the most serious problem in the modern society, particularly in the ecologically sensitive arid and semi-arid areas. Rangeland degradation implies a reduction in rank or status, which includes a loss of top-soil, a change to a simple floral/fauna composition or a transition from one organic form to a lower organic form, and continuous reduction of productivity/biomass of the ecosystem.⁴ Once rangeland has been degraded, it is often possible to rehabilitate it and thus restore it to a level of utility, possibly not as its original state, but better than it was in its damaged state.⁵ Rangeland degradation is the most extensive types of current land use problems mainly in Yabello area. Overgrazing by livestock is the principal land problem in the arid and semi-arid regions, coupled with land use change to cultivated farmland in the many countries including Ethiopia.⁴ Changes in natural vegetation dominated by the grass layer, leading to dominance of woody cover and increase in unpalatable forbs are considered as a threat to range conditions in Yabello.⁶ Restoration of land degradation is essential to ensure long term productivity of semi-arid rangeland of Yabello. For improving pasture quantity and quality where graminoid and nongraminoid herbaceous plant species have disappeared have been limited to

destocking, bush management, and intermittent grazing⁷ and its basic objective is to encourage palatable, productive perennials, as they are good for animal performance and to maintain a healthy environment.⁸ Other methods such as ripping and grass reseeding has the potential to restore degraded rangelands and improve their potential for livestock production.⁹ The Yabello pastoralists traditionally practiced strategic grazing management to avoid local overstocking around the scarce dry season water sources. The different measures taken were: cultivation of land, share cropping, formal employment in mechanized farms and other organizations, casual labor and small trade. As documented by Solomon,¹⁰ most of these strategies were utilized by pastoralists for risk management strategies when sole dependency on livestock is in question. Understanding the socio-economic impacts of rangeland rehabilitation is essential to the management and planning of similar initiatives. So this study aimed to quantify the benefits derived from the rehabilitated semi-arid rangeland in Yabello area, Southern Ethiopia.

Materials and methods

Description of the study area

The study was made at Dida Tuyura, Danbal-Waccu and Arero kebele of Yabello district Borana zone, southern Ethiopia in 2018. It is situated at 566 km south of Addis Ababa along Addis-Moyale road. The area of Yabello town is 5426 km², and located between 4°30'55.81" and 5°24'36.39" north latitude and between 7°44'14.70" and 38°36'05.35" east longitudes, the altitude is about 1000-1500m, maximum altitude of 2000m. The area has a bi-modal rainfall regime, with mean annual rainfall ranging from 400mm in the south to 600mm

in the north. Which is the 73% of rainfall occur in March to May, the 27% of rainfall occur in September to November.¹¹ The potential evapotranspiration is 700-3 000mm.¹² The study area also dominated by savannah vegetation containing mixtures of perennial herbaceous vegetation. It is also confronted with the problem of bush expansion in the native savannah grass lands. Besides the area characterized by savanna grass land. There is no detailed information on the soils of Yabello rangelands. However, the main soils of the region comprise 53% red sandy loam soil, 30% black clay and volcanic light coloured silty clay and 17% silt and vertisols (Coppock 1994). Four major vegetation types have been described:

- (i) Evergreen and semi-evergreen bush land and thickets, found north of Yabello, Arero and Negelle stretch
- (ii) Rangeland dominated by Acacia and Commiphora trees, covering most of the rangeland area extending in central, south and west directions
- (iii) Rangeland dominated by shrubby Acacia, Commiphora and allied genera, confined to water sources and depressions covering some portion of the western parts of the rangeland with barren land between
- (iv) Dwarf shrub grassland or shrub grassland, in the eastern parts of the rangeland where the soil is very shallow and sandy. According to Coppock (1994), woody plants contribute from 5–75% of total

plant cover on the Yabello plateau depending on location (Figure 1).

Methods data collection

Three kebeles (Arero, Dada Tuyura and Danbal-Waccu) has been chosen to carry out this research through purposive selection techniques based on the information gathered from different aspect like similarity of terrain, soil, and land use aimed at minimizing variability in the abiotic determinants of rangeland vegetation composition and functioning and hence productivity. And rangelands that rehabilitate by using enclosure methods was selected for this research purpose in order to assessed both the qualitative and quantitative benefits of the local community from this area. Semi- structured interview, Focal group discussion was held with key informants and different stakeholders at each kebele level have been conducted to gather information. The basic issues addressed in the questionnaires include community knowledge about rangeland use, feeding frequency, duration of forage availability for use, critical period of forage shortage, and its proximity. Data of functional both from enclosure and non-enclosure rangeland area were collected to make comparison. Totally 150 respondents, 50 people from three (3) kebeles have been interviewed for the assessment. The ages of respondents were older than 25 years in order to ascertain the efficiency of their experience with impact of forage resource on the study area (Figure 2).

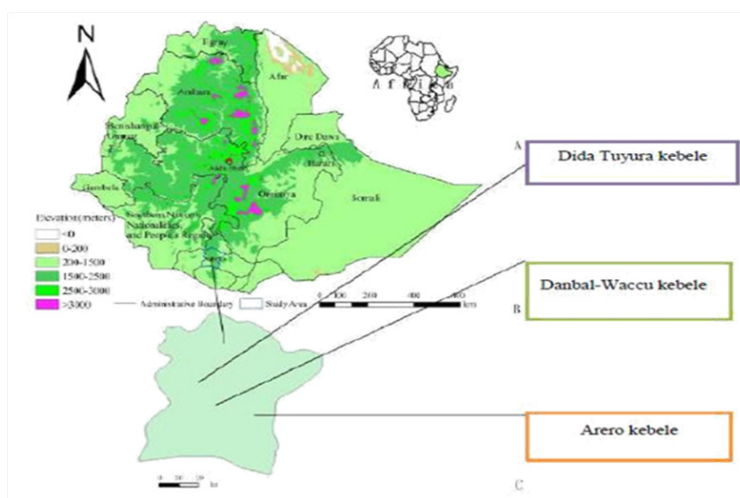


Figure 1 Geographical location of study areas.



Figure 2 Interview and group discussion with the local community of Yabello pastoralists together with stakeholders (photo taken by Yeneayehu F. Dec/2018).

Data analysis

Analysis of data combined both qualitative and quantitative approaches. The analysis began from revising detailed field notes and consolidating similar information from enclosure field reports and sorted out it. The results were categorized into two: the quantitative [tangible product or good that had immediate economic value] and qualitative [those that improved the welfare of the individual household, communities or overall society and the environment but could not be converted immediately into cash].¹³

Result and discussion

Based on the data that obtained from the stockholders and interview result the enclosure rangeland area mainly used for livestock fattening, grazing, wood cutting and charcoal burning activities in all of the three sites (Table 1). And the interview result indicated that among the three enclosures rangeland site Dida Tuyura enclosure rangeland generated the highest per hectare income and had the highest number of income generating activities and income portfolio followed by Danbal-Waccu and Arero respectively which is most diversified in terms of income with 83% coming from Livestock fattening and sale it. And the income rate showed that an increasing trends from time to time (Figures 3–5).

Quantitative benefits

In the rangelands area that rehabilitated mainly in the enclosures techniques fattening of cattle was the most profitable activity and mainly depends on pasture that obtained from the enclosures

rangelands, and no other feeds were supplied. Those peoples that live around on this rehabilitated rangeland area livestock fattening activities based on buying thin cattle from the local market during the dry season in low price and then properly feed those cattle in the enclosure rangeland area during the time of grazing period with an average of from 3-6months until it becomes fat as they need in the local market system and until arrived the expected selling price. According to the data obtained from interview result the average buying price for a thin cattle was from 2500-3000 ETB (92-110USD) and between 3-6 month the total income profit was in average from 9,000-12,000ETB (350-440USD) excluding the salary that bought at the beginning. And also this fattening practice performed in group that are found in the some local area. All group members contributed both in labor (activities) and budget including operational costs such as veterinary drugs and herders wage contributed equal to the fattening practice and the profit was retained by the group and shared it at the end of the accounting year. Dry season grazing was another key utilization of the enclosures rangeland areas and generated an income for all the local community that is beneficiary from this enclosures site. Those category of the livestock grazed showed the priority of the groups managing the particular enclosure. For instance, in both site of the enclosure rangeland site the local community largely practiced for livestock fattening and for cattle and sheep dry season grazing. And this mainly used to sustain the livestock through the dry season and drought. During the rainy season, livestock graze in the communal open rangeland and the enclosure rangeland area serve as a buffer against dry season pasture scarcity and accompanied livestock losses (Figure 6) (Figure 7).

Table 1 Some general information about the selected enclosed rangelands

Code	Local name	Sub-district	Total area (ha) of selected site	Utilization
A1	Dida Tuyura	Yabello	7.5	LF–G–WC–CB
A2	Danbal-Waccu	Yabello	7.5	LF–G–WC–CB
A3	Arero	Yabello	7.5	LF–G–WC–CB

Note: LF, livestock fattening; G, grazing; WC, wood cutting; CB, charcoal burning

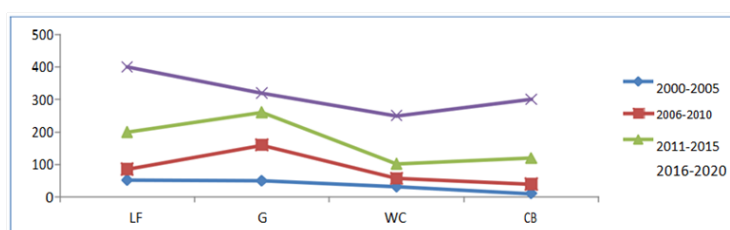


Figure 3 Range land utilization change in number from 2000-2020 in the Dida Tuyura (A1) area (data generated based on the local community interview result) as a result of rehabilitation.

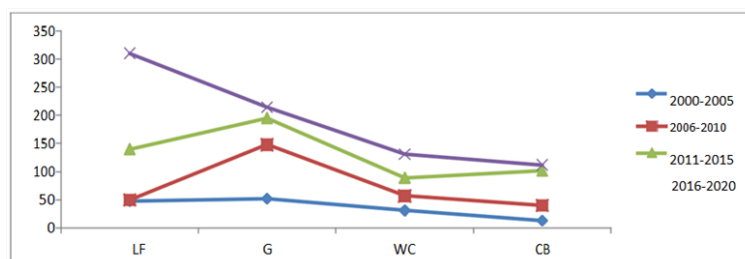


Figure 4 Range land utilization change in number from 2000-2020 in the Danbal-Waccu (A2) area (data generated based on the local community interview result) as a result of rehabilitation.

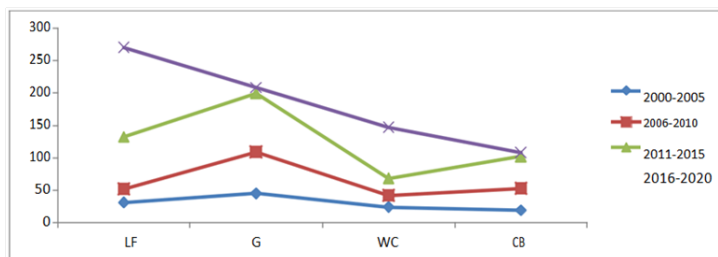


Figure 5 Range land utilization change in number from 2000-2020 in the Arero (A3) area (data generated based on the local community interview result) as a result of rehabilitation.



Figure 6 Rehabilitated rangeland area through enclosure (photo taken by Yeneayehu F. Dec/2018)

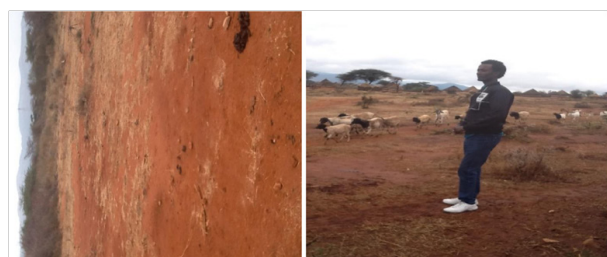


Figure 7 Degraded area (non- enclosure rangeland) with in the same location (photo taken by Yeneayehu F. Dec/2018).

Qualitative benefits

In addition to the numerical value, those rehabilitated area have also other non- measurable importance both for the local community and also the livestock and further for environmental issue. Those benefits derived from as a result of rangeland rehabilitation were summarized as follows (Table 2).

Table 2 List of some qualitative benefits derived from rehabilitation of degraded rangeland, measurement methods and ways implemented to be achieved

No.	Benefits obtained from rehabilitation of degraded rangeland	Measurement techniques and ways used to achieved the obtained benefit
1	Improved land and livestock management	-Trained many agropastoralists on rangel and Rehabilitation, grazing management, sustainable Enclosure utilization practices and diversification of income-generated activities and opportunities and this efforts are based on realization that there are also other more alternative benefits with related to both livestock and humans.
2	Sustainable rangeland rehabilitation	-Appropriate rehabilitation techniques and water harvesting methods have been defined and tested. -Monitoring exercises carried out in the restored sites show high biodiversity of flora and fauna compared with the open grazing areas. -Source of good-quality feed for livestock was obtained and observed. -Become source income through the sale of grass seeds.
3	Improved communities livelihood	-Balanced diet obtained from milk especially for children. -Other social amenities like health, education and entertainment facilities were become observed. -Water pans and dams within the established enclosures keep water longer than the ones in the open rangeland.

In general, the central core idea for assessing the benefit of rehabilitating of degraded range land areas in Yabello was used as a demonstration for degraded range land area can be rehabilitated and used for addressing different livelihood problems of agro pastoral community¹³ and the summary of this benefit was tried to address in Figures 3–5, Table 2 and Table 3. This result was in agreement with¹⁴ the study conducted in northern part of Ethiopia in Tigray region. Those factors productivity, management and benefits of the rehabilitated range land were directly linked with its sustainability, this told us the sustainability of one is resulted the sustainability of the other (Figure 8).

The obtained benefit variation among the three rehabilitated area that have equal hectare size resulted from the capacity of the management of the local community together with other both biotic and abiotic factors. In Yabello, the urgent task that focused for long time activity is to carry out stepwise community mobilization and education to enable the resource users to embrace sustainable rangeland management both before and after degradation occurred. This includes making the right choices of species for restoration, controlled invasive species like *Prosopis (P. juliflora)* and cactus (*Opuntia elatior*) that are invasive and sustainable utilization (e.g. stocking density and number of grazing days) are a prerequisite to optimizing the potential environmental goods and services from the restored areas. Therefore, continued extension services and participatory education on management of the rehabilitated range land area to the local community groups are vital for the sustainability of the achievements attained so far.

Table Continued

No.	Benefits obtained from rehabilitation of degraded rangeland	Measurement techniques and ways used to achieved the obtained benefit
4	Crate social cooperation	-Individuals or community groups came together to work in the communal enclosures in the spirit of lemat sera (In Amharic). -Increased sustainability of the rangeland rehabilitation initiatives as a result of the occasional maintenance of the communal enclosures through different activates.
5	Local community capacity building	-Trains individuals and community groups as environmental managers, and many have benefited directly from restored areas and enclosure products. -The environmental and financial skill capacity building

Table 3 Some numerical and non-numerical benefits obtained from rehabilitated rangeland area based on the data recorded from the local community during field visit

No.	Benefits obtained from the rehabilitated area	Measuring parameter	Income source product	Estimated price (USD)
1	Livestock fattening	No. of cattle per day	Fattened	389 per head
2	Grazing purpose	No. of grazing per day	-	-
3	Wood cutting	No. of tree species cut	Building poles/ Fencing posts	5.6 per piece
4	Charcoal burning	No. of tree cut per bags	Charcoal	12.96 per bag

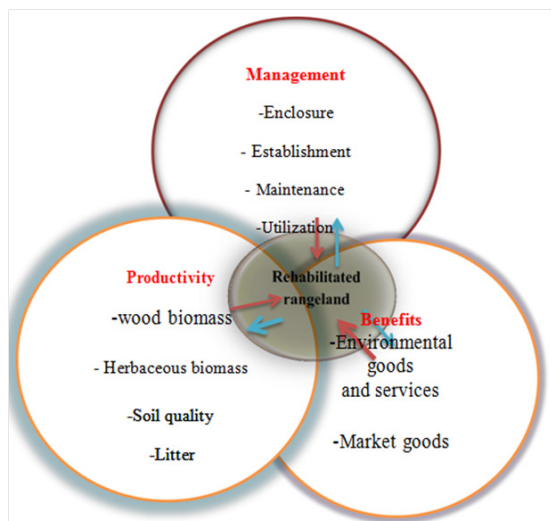


Figure 8 Frame work that shows the linkage between factors and the rehabilitated rangeland area.

Conclusion

From this study result we can concluded that in all study site (A1-A3) the rehabilitated rangeland mainly serve for livestock fattening, grazing purpose, wood cutting and charcoal production and among this livestock fattening is the major source of income across the whole study site and Dida Tuyura (A1) is the most productive site among the rest. In addition to these numerical benefits the rehabilitated area also gives more non-numerical benefits both for livestock and the local community and in the long run for the environmental issue. In general we can recommend that there is a need to enhance market linkages for restored rangeland products that would then drive the adoption of rangeland restoration initiatives and those helps for sustainable utilization of the rehabilitated rangeland and also in order to avoid further degradation of rangeland in the Yabello rangeland area.

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Conflicts of interest

The authors declare that there is no competing of interest.

References

1. Teshome A, Ayana A. Conversion of savanna rangelands to bush dominated landscape in Borana, Southern Ethiopia. *Ecological Processes*. 2016;5(6):1–18.
2. Irwin F, Ranganathan J. *Restoring nature's capital: an action agenda to sustain ecosystem services*. World Resources Institute; 2007:71–80. ISBN 978-1-56973-641-8.
3. Ayana Angassa. The ecological impact of bush encroachment on the yield of grasses in borana rangeland Ecosystem. *African J Ecol*. 2005;43(1):14–20.
4. Barrow CJ. *Land degradation*. Cambridge: Cambridge University Press; 1991.
5. Feyera S, Christine S, Tadesse W, et al. Plant diversity, vegetation structure and relationship between Plant communities and environmental variables in The Afromontane forests of Ethiopia. *SINET: Ethiop J Sci*. 2014;37(2):113–130.
6. Oba G, Post E, Syvertsen PO, et al. Bush cover and range condition assessments in relation to landscape and grazing in southern Ethiopia. *Land scape Ecology*. 2000;15(6):535–546.

7. Angassa A. Effects of grazing intensity and bush encroachment on herbaceous species and rangeland condition in southern Ethiopia. *Land Degradation & Development*. 2012;25(5):438–451.
8. Saco PM, Willgoose GR, Hancock GR. Eco-geomorphology and vegetation patterns in arid and semi-arid regions. *Hydrol Earth Syst Sci Discuss*. 2006;3:2559–2593.
9. Mekuria W, Veldkamp E, Tilahun M, et al. Economic valuation of land restoration: The case of exclosures established on communal grazing lands in Tigray, Ethiopia. *Land Degradation & Development*. 2001;22(3):334–344.
10. Solomon T, Snyman HA, Smit GN. Rangeland dynamics of southern Ethiopia: (1) Botanical composition of grasses and soil characteristics in relation to land use and distance from water in semi-arid Borana Rangelands. *Journal of environmental management*. 2007;85(2):429–442.
11. Dalle G, Maass BL, Isselstein J. Rangeland condition and trend in the semi-arid Borana lowlands, southern Oromia, Ethiopia. *African Journal of Range & Forage Science*. 2015;23(1):49–58.
12. Billi P, Alemu YT, Ciampalini R. Increased frequency of flash floods in Dire Dawa, Ethiopia: Change in rainfall intensity or human impact?. *Natural Hazards*. 2015;76(2):1373–1394.
13. Stephen M Mureithi, Ann Verdoodt, Jesse T Njoka, et al. Benefits derived from rehabilitating a degraded semi-arid rangeland in communal enclosures, Kenya. *Land Degrad. Develop*. 2015;27(8):1853–1862.
14. Mekuria W, Veldkamp E, Corre MD, et al. Restoration of ecosystem carbon stocks following exclosure establishment in communal grazing lands in Tigray, Ethiopia. *Soil Science Society of America Journal*. 2001;75:246–256.