

Assessment of Rangeland Management Approaches in Yabello: Implication for Improved Rangeland and Pastoralist Livelihoods. Review Paper

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Abstract: The arid and semi-arid agro-ecological area of Ethiopia covers more than 62% of the total land area. The Yabello rangeland occupies a large geographical area in the Borana rangeland of Ethiopia. Rangelands are used primarily as a source of feed for livestock. They, however, provide other secondary resources such as firewood, wild foods, medicinal plants, and water. Land degradation is the major challenge in the rangelands of the earth. Rangeland degradation is occurring as a result of no grazing management plans, removal of vegetation for fuel wood and no clear authority of rangeland ownership. The major indicators of rangelands degradation are shift in species composition, loss of range biodiversity, reduction in biomass production, less plant cover, low small ruminant productivity, and soil erosion. So the basic aim of this review paper is to assess the rangeland management approaches and rehabilitation mechanisms and efforts in the Yabello rangeland Southern Ethiopia through in-depth revised of different source. This analysis begins the question of what can be done to revitalise the degraded rangelands of Yabello. The author therefore analyses the key rangeland management techniques being employed by local people to rejuvenate this natural resource base and assesses their strengths and weaknesses in order to recommend a way forward. The paper suggests that indigenous knowledge and skills can serve as a useful guide for managing the rangelands while at the same time enabling the Yabello pastoralist community to engage with and take ownership of this development assistance and support.

Keywords: Rangeland, management approaches, Rangeland degradation, Livestock

1. INTRODUCTION

In order to maintain healthy and productive livestock (and livelihoods) for Yabello pastoralists, there is a pressing need to ensure that the grasslands available are well managed. As we have seen, the Yabello rangelands have traditionally been managed by customary institutions, but with the onset of various pressures, this management system is increasingly undermined (Abate *et al.*, 2009). In the past 'imported' approaches to rangeland management in semi-arid regions like Yabello haven't helped the situation (Donald, *et al.*, 2012). The major indicators of rangelands degradation are shift in species composition, loss of range biodiversity, reduction in biomass production, less plant cover, low small ruminant productivity, and soil erosion. Rangeland degradation is occurring as a result of no grazing management plans, removal of vegetation for fuel wood and no clear authority of rangeland ownership (Eswaran *et al.*, 2001). Two important, Western-led concepts have affected government and NGO policy regarding rangeland management to a greater or lesser degree: 1) the equilibrium model, and 2) the 'tragedy of the commons'. The equilibrium model was developed in the relatively stable and predictable western temperate ecosystems and assumes predictable forage production. In this model the equilibrium of the eco-system becomes unbalanced when animal populations exceed a certain number and overshoots the 'carrying capacity' of the land. Thus livestock stocking densities are seen as a contributing factor to bush encroachment and with it land degradation. Hardin's (1968) 'Tragedy of the Commons' postulated that, with livestock owned individually and rangeland held in common, the incentive for individual profit inevitably drives over-stocking and environmental degradation at the expense of the group (Homewood, 2008).

The thinking behind these two models has for a start underpinned, ‘national and international policy pressure to privatize rangelands with drastic implications for individual, household and group access to the basic means of pastoral production and associated livelihoods’. The repercussions have included a misconception of range ecology which has led to ideas that pastoralists maintain livestock far above the carrying capacity of the rangeland and hence run a risk of permanent land degradation. To avoid this, de-stocking and state controlled grazing schemes or ranches were imposed based on western ecological models of carrying capacity (Scoones, 1996; Elias, 2008). Moreover, there is increasing scientific evidence that show that pastoralist rangeland management strategies, such as animal movement (rather than grouping into ranches) are good adaptations to these unpredictable environments and that carrying capacity is irrelevant to such environments (Mureithi *et al.*, 2014). The tragedy of the commons concept has similarly been challenged with recognition that the pastoralist management system works for the good of the community and that it cannot support the individualization of interests. Degraded ecosystems characterized by low productivity, low diversity or both are often trapped in stable states, showing little or no improvement over time. Restoration can improve their utility. Identification of putative abiotic and biotic barriers to the natural regeneration of more desirable vegetation can lead to the implementation of appropriate restoration treatments (Whisenant, 1999).

Pastoral communities usually have a detailed knowledge of their grazing lands, acquired through extensive observation and continuous herding practice (Oba and Kotile, 2001; Mapinduzi *et al.*, 2003). Despite the existence of such knowledge, researchers and development policy experts have previously overlooked community-based knowledge when evaluating rangelands. Turner *et al.* (2000) concluded that traditional knowledge of indigenous people was fundamentally important in the management of local resources. Other studies (Fernandez-Gimenez, 2000) also showed that documenting indigenous knowledge of rangeland resources can provide useful information for the development, sustainable utilization and conservation of natural resources. Additionally, community-based knowledge may provide new insights for improving existing scientific knowledge and a basis for designing appropriate research and development policies. In most parts of Ethiopia, the indigenous knowledge of pastoralists is not adequately documented (Gemedo; *et al.* 2014 and Worku, 2016). More work needs to be done on this front – as noted by the Natural Resource Management Advisor at SCUS Ethiopia, for example, more scientists are needed on the ground to properly assess the ecology of rangeland dynamics (Fiona Flintan, personal communication). Importantly for now, however, work stressing the value of indigenous knowledge in establishing appropriate rangeland management strategies is gaining increasing prominence (Angassa, 2007). On the basis that pastoralists have a good understanding of how their environment works and how to manage it, organizations such as CARE Ethiopia, amongst others, are incorporating customary rangeland practices into their rangeland management strategies. Following on from the above debates and new thinking in rangeland management approaches, beneficial lessons which should be kept in mind regarding rangeland management are:

- The Yabello rangelands are a disequilibrium system. Heavy grazing alone, therefore, does not promote land degradation and disturbances may have a beneficial rather than detrimental effect.
- Traditional rangeland management techniques have developed to optimise rangeland productivity for the benefit of pastoralists’ livelihoods. Lessons can be drawn from Yabello pastoralist management strategies.

This paper attempts to present a critical review of the rangeland resource management approaches in the Yabello rangeland area of Southern Ethiopia.

2. OBJECTIVE OF THE STUDY

The general objective of this study is to review the rangeland management approaches and rehabilitation mechanisms and efforts in the Yabello rangeland Southern Ethiopia. The specific objectives are to: (i) demonstrate how rangelands were traditionally managed and (ii) delineate approaches to rangeland management, the pros and cons, and provide recommendations for successful rangeland management.

3. METHODOLOGY

3.1. Description of the Study Area

The study was made at DidaTuyura, Danbal-Waccu and Arerokebele 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 longitude, the altitude is about 1000-1500 m, maximum altitude of 2000 m. The area has a bi-modal rainfall regime, with mean annual rainfall ranging from 400 mm in the south to 600 mm in the north. Which is the 73% of rainfall occur in March to May, the 27% of rainfall occur in September to November (Dalle G. *et al* 2015) .The potential evapotranspiration is 700-3 000 mm(Billi P. *et al* ;2015).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 Borana 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 (AGROTEC 1974): (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; and (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 Borana plateau depending on location.

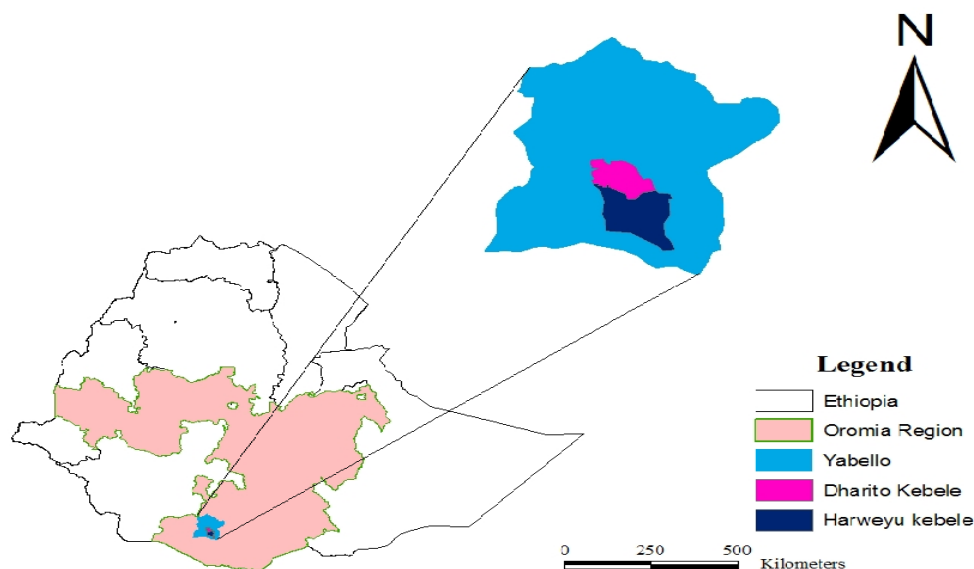


Fig1. Location map of the assessment areas

3.2. Methods Data Collection

To accomplish this paper, in-depth literature review was employed using various secondary sources from books, journals, and websites. The required information was analyzed qualitatively using detail literature citations for each sub topics.

4. TECHNICAL APPROACHES TO RANGELAND MANAGEMENT

International NGOs, such as CARE, SCUS, Action for Development (AFD) and SOS Sahel, are working to improve rangeland management in Borana where there are issues of bush encroachment and land degradation. The following discussion will look at the relative merits of some of the technical approaches being implemented, based on interviews with pastoralists, representatives from the above-mentioned NGOs and research literature. Encroaching woody species are recognized as reducing grazing land through colonizing rangeland, as well as out-competing herbaceous grasses for

nutrients, thus reducing grass cover (and feed for livestock). The proliferation of woody species is thus seen as a cause of land degradation. Changes in grazing patterns, due to vulnerabilities which constrict rangeland usage, appear to be exacerbating the effect and heavy grazing in areas seems to encourage further bush encroachment. While the spread of woody plants are a symptom of wider vulnerability issues, the net result is that they further the effects of fragmenting rangelands. Technical approaches have thus been geared towards counteracting the proliferation of these plants and encouraging grass growth through the following main approaches: 1) Hand cutting woody 2) Prescribed fire, species, 3) Enclosures (*kallos*), 4) Resting of Pasture Land, 5) Reseeding and others.

4.1. Hand Cutting Woody Species

Hand clearing woody species involves pastoral communities in physically cutting down unwanted trees. This method is more discerning than fire since trees can be selectively cut, rather than indiscriminately burned some trees e.g. the shepherd's tree, are useful animal fodder. Prior attempts to address bush encroachment in this manner involved intensively cutting large areas of bush. This method, however, has been found to have limited impact since most of the invasive species re-sprout after cutting (Demeke, 2009). Tree cutting is not working, explained a herder involved in one of the latest projects, 'trees grow too fast, cut one; another grows' (personal communication). After 15 years of experience following this method, SOS Sahel has given up since, 'plots which were cleared then are now again overgrown with acacia' (MitikuTiksa, SOS Sahel, personal communication). Some other drawbacks to the method include Angassa's observation, that since the method is labour intensive and trees have to be regularly cut, it would only work for land which was easily accessible. For practical purposes, therefore, tree cutting wouldn't be a method which worked for vast swathes or rangeland, but rather for designated areas near settlements which could serve as reserves for the weak or sick animals. Another issue raised by MitikuTiksa was that the system is also ineffective long term since it is not part of the pastoral production tradition to clear trees and is therefore a difficult habit to ingrain. In the case, a mixture of approaches appears to be more effective in reducing bush cover, (i.e. cutting trees followed by fire, cutting trees followed by resting the land etc.), although in most cases organizations are still experimenting with the most appropriate combinations of approach.



Fig2. Rehabilitation of rangelands in Yabello by cutting woody bush encroachments

4.2. Prescribed Fire

Fire is a key environmental driver that controls the function of savannah ecosystems. It was a tool used by Yabello pastoralists to suppress bush growth by killing encroaching woody species. Suppressed by the government in the early 1970s, it is now being slowly re-introduced (Angassa and Oba, 2009). Conversations with pastoralists revealed that burning also gets rid of ticks, which infest cattle, and produces sweet grass for animals (Yabello elders, personal communication). When asked, Yabello pastoralists said that they believed that the ban on fire had adversely affected the overall productivity of the rangelands (Yabello elders, personal communication). Since fire had been used traditionally, they also preferred the idea of this rangeland management tool as it echoed one of their own practices with associated good results (MitikuTiksa, Field Manager Yabello, SOS Sahel, personal

communication). Bearing these factors in mind, NGOs are re-introducing burning as a rangeland management technique through 'prescribed fire' - the controlled and managed application of fire to defined units of grassland.

However, some of the long-term consequences of fire are drying of the land, reduction of plant cover and loss of nutrients (Hatfield, personal communication; Demeke, 2009). Moreover, fire treats the symptoms of land degradation rather than the underlying causes, thereby becoming more and more necessary since the problem will persist (Hatfield, 2009). Practical considerations, mentioned by pastoralists and development staff alike, are that the fuel load (ground cover) is now so patchy that it can be difficult to get a fire started and maintained. Moreover, the proliferation of villages in the area could constitute a hazard should fires get out of control. As a tool on its own, fire may not have long-term sustainable benefits, but it is an approach favored by pastoralists and has worked well as a short-term, repetitive strategy in the past. Taking this into account, one option is to combine prescribed fire with grazing animals, following a period of rest. This concedes even more with traditional pastoralist practice and allows the fertilization and conditioning of the soil through hoof action and dung, thus encouraging re-growth. In a practical study conducted to compare the merits of different rangeland management systems, Angassa found that combining fire with grazing achieved a restoration of herbaceous plant diversity (Angassa, 2007). Precautions would have to be taken however to ensure that burning is kept within prescribed areas as not all areas are appropriate (Getachew Gebru, Pastoral Risk Management Program, ILRI, personal communication). As noted by Cary Farley of the ELMT/ELSE project, amongst others, we still don't have enough knowledge of the impact of fire on unwanted bushes and desirable grasses as there hasn't been sufficient monitoring of its effects. It is therefore an area requiring further investigation in order to determine its suitability for the changing ecology of today's Yabello rangelands.

4.3. Enclosures

In response to changes in land use, the Yabello revised the traditional system of grazing reserves specifically set aside for calves and weak animals (*kallos*). These tended to be open pasture in key grazing landscapes such as hill tops and valleys and were set aside for calf and weak animal grazing through community consensus. Some of these areas have been converted into crop land, but others have been preserved by households as traditional calf-grazing reserves. In order to protect them, the areas have been enclosed by perimeter fences (Oba and Angassa, 2008). Drawing from these practices, NGOs such as CARE and SCUS have helped establish new enclosures by facilitating village level meetings to agree on land which can be put aside for this purpose. The land is then enclosed with thorn fences to prevent un-condoned grazing. By reducing grazing pressure the land can 'rest' and recuperate. In order to rid the area of woody species, the area is also usually hand cleared of trees.

These enclosures are in keeping with traditional practice and pastoralists interviewed generally seemed happy with the results. Because they are labour intensive, however, again this system can only work for areas close to villages for maintenance purposes, and pastoralists would need to keep up the incentive to regularly clear invading bushes. Closer inspection of the land by holistic management consultants found that this protected land still showed signs of degradation with grasses growing in patches and hard, compacted soil acting as a deterrent to water absorption. A study of the long-term consequences of treating land in this way also revealed that the proliferation of bush encroachment is a major threat in these enclosures over time, as compared to more regularly grazed rangelands (Angassa, 2007). In maintaining *kallos*, time is an often a mismanaged element the *kallos* should be left for long enough to recover, but not for so long that they start to deteriorate, as seen in a private ranch where 15 years of underuse have led to steady bush encroachment. Grazing animals should be reintroduced in a timely manner so that biological processes can again take place. These *kallos*, might also be used as a dry season grazing reserve in times of drought when the large numbers of animals would attract huge numbers of ticks. Prescribed fire could help to control this particular phenomenon (Biruk Asfaw, SCUS, personal communication). Enclosures help protect land to a certain extent, but as with the other approaches, are more effective when combined with other techniques such as bush clearing. In order for the enclosures to be sustainable over time they also require careful management.

4.4. Resting of Pasture Land/Deferred Grazing

Deferred grazing means delayed grazing. This is the simplest and most effective range improvement and rehabilitation method that can be practiced if the idea is accepted and the set regulations are properly implemented by the beneficiaries. The longer the beginning of grazing on a range is delayed, the better the opportunity exists for new plants to become established and for old plants to gain vigor. If grazing can be deferred (rested) every few years, forage plants will have better opportunity to reproduce. Therefore, resting pasture land periodically from 3 to 12 months depending on the magnitude of the spoiled area and, then, allowing controlled grazing can improve forage productivity. Hence, the resting period should extend throughout one complete wet and dry season grazing period every 4 or 5 years. Since SNRS is vast and constituted diversified range vegetation, this coping strategy will be one of the best options (PFE *et al.*, 2010).



Fig3. Change of degraded rangeland after 2 years resting of in Yabello

4.5. Reseeding

Reseeding involves collecting seeds from existing grasses and then sowing them on bare ground. This approach has had only minimal attention and results to date. Positive results came from one experiment conducted by the Oromiya Agricultural Research Institute, but a similar attempt by Action for Development proved unsuccessful. This method assumes that the dearth of grasses is due to a lack of seeds. Often, however, seeds are readily available and are still in the ground, but they do not have the right conditions in place to grow (Yami and Merkel, 2009). The reseeding approach would involve ground preparation using fertilizers and ongoing nurturing, as well as encouraging pastoralists to collect enough seeds in the growing season to sow the land when needed one obstacle which Action for Development ran into since the concept was still new to pastoralists. This approach could be considered in particularly barren areas, but would be labour intensive, not particularly cost-effective and would have to first be taken on board by the pastoralist community (Gebru *et al.*; 2007).



Fig4. Reseeding methods that practice in the local community and different researchers (both Picture of Ripper line and Ploughing method)



Fig5. Forage seed adaptation tests through reseeding in Yabello rangeland

4.6. Movement between Dry Seasons

Development of pastoral production systems in Ethiopia, especially in the Yabello rangelands is facing significant constraints. The major constraint is that rangelands are increasingly unable to support pastoralists and their livestock. This is, primarily, the result of rapidly growing pastoral populations made worse by the loss of high potential rangelands to other types of land use. However, pastoralists exploit the available natural resources in a systematic way. Movement between dry season and wet season pasture is a traditional form of pasture rotation, deferment (resting of pasture land) and sometimes a means of avoiding disease outbreaks. The rational strategies of pastoralists can be efficient and complex. Such movement of livestock has the following benefits (Yami and Merkel, 2009).

- Dry season pastures are allowed a period of rest and growth during the wet season, which maintains and sometimes increases the plant biomass.
- Wet season pasture often has abundant natural ponds, thus, reducing the need for labor to water animals at least for part of the year.
- Period of rest breaks the cycle of disease and parasites that tend to build up around dry season wells.

4.7. Development Agents

Agents like NGOs play great roles in rehabilitating rangeland ecology, particularly, in pastoral communities including those in Yabello area. These include (Gebre *et al*; 2009):

- Identify the pastoral/agro-pastoral leaders and progressive community members and create a close working relationship;
- Learn their indigenous knowledge regarding animal production, use of natural pasture, general conditions of dry and wet season grazing areas and animal health, and record important points for future use;

- Record local names of valuable plant species in the area used as livestock feed and other purposes and have them identified scientifically in order to know uses and potential problems from the literature.
- Identify major livestock problems of the area and discuss appropriate prevention or treatment measures with the community; participate in the implementation of planned interventions;
- Carry out inventories in the dry and wet seasons grazing area resources through discussions with community leaders and visual assessment to determine potential production and problems. Give emphasis to the following components: (i) livestock water sources by type (birca, bore holes, hand dug wells, ponds and rivers); (ii) status of grazing and browsing resources; and (iv) problems regarding resource use.
- Based on the rough assessment of the three components, namely, livestock number, amount of water and available forage, identify the magnitude of problems and suggest appropriate actions; and
- Mobilize the community through elders and progressive pastoralists to clear unwanted plant species at early stage (parthenium and prosopis) and participate during implementation.

4.8. Traditional Institutions

Pastoralist communities have accumulated centuries of experience and knowledge about resource management. Traditional institutions are run almost exclusively by older men who make decisions that affect everyone else in society. They set rules and regulations that forbid inappropriate practices, they ensure that rangeland resources are used and maintained properly. They also arbitrate disputes. The leadership negotiates with neighboring groups on the use of water and pasture and allocates range and water resources. Their key strategy is managing mobility; they decide if, when and where the community should move. Traditional management of pastoralist rangelands depends on careful and wise use of community knowledge. The main consideration is availability of pasture and water. To ensure the availability of good pasture, pastoralists practice herd splitting and range burning. Herd splitting conserves and safeguards range resources from being degraded and overgrazed and reduce competition among various livestock age groups. Herds and flocks are broadly split into base and satellite herds. In most pastoralist communities, very young animals are tended by the boys and girls while the men look after the adult herds at a distance from home. Lactating animals, which provide milk for families are herded near settlement centers while the dry and pregnant females travel long distances in search of pasture and water. Due to factors like increases in human population and land degradation, the practice of herd splitting is on the decline (Yami and Merkel, 2009).

5. CONCLUSION

The technical approaches to rangeland management described above, particularly prescribed fire, cutting trees and enclosures, are 'providing some relief' to the problems of rangeland degradation (Aliyu Mustefa, CARE Ethiopia, personal communication). The pastoralist management techniques of prescribed fire and preserving enclosures for use at specific times or for specific animals have been shown to improve grass production. These methods are also preferable since they do not introduce new systems of management into the Yabello system, but draw on existing practice. On their own, however, they do not *systematically* improve grass production and need to be combined with other strategies such as resting the land, grazing or with each other techniques as well as ongoing management, in order to give better results. Moreover, they tend to address the *symptoms* of land degradation rather than the causes bush encroachment, for example, is the consequence of drier ground, a consequence of ongoing exposure to fire and changing grazing patterns. So bush encroachment will continue to be a *symptom* which has to be dealt with. NGOs are still experimenting with ways to improve the quality of the rangelands and at this stage what is needed is more input from ecological experts, more experiments on permanent bush reduction, and more holistic thinking the rangelands have been managed holistically for centuries and to impose one technical approach e.g. fire, without other considerations of what is needed, is out of keeping with both the traditional way of managing rangelands and with establishing sustainable, self-perpetuating healthy grasslands. A holistic-thinking approach which takes account of livestock, pastures and people is advisable to avoid further damage to an already fragile landscape and livelihood.

6. RECOMMENDATIONS

Based on the findings in this review paper, the following recommendations are forwarded:

- National governments should adopt policies for the conserved use of rangelands and where possible of rangeland improvement consisting of extension and aid programs, supported by the local community, with the help of international multilateral agreements and development programs.
- Rangeland scientists and managers should collaborate to develop monitoring systems that track and predict how changes in land use and cover affect ecosystem function across spatial scales on rangelands.
- There should be an increased research and development emphasis on managing rangelands to produce sustainable alternative products and ecosystem services. Sustainability in the face of global change will require quantitative knowledge of ecological thresholds, indicators of change and key decision points in the framework of comprehensive monitoring systems. Forward-thinking, manipulative field research provides a solid foundation for making predictions about the response of ecosystems to global change within the context of contemporary rangeland management.
- There should be strong links among researchers, managers, and local land users to improve science, management, and rangeland ecosystems.
- Indigenous knowledge on species and their utilization be considered.
- Conducting further trials to see how effective combined techniques can be e.g. cutting trees followed by burning.
- Developing thinking which considers the ‘whole’ – the complex, interacting ecological system not just the symptoms of degraded land, for long-term, sustainable results.

AUTHOR CONTRIBUTIONS

Available data collection, writing up and gap assessment was done by Yeneayehu Fentehun while grammar edition as well as some necessary things that had been included were performed by Professor XU-Xinwen and Dr. Wang Yong-dong.

FUNDING

Science and Technology partnership program, Ministry of Science and Technology of China (KY201702010); China-Africa joint research center project of the Chinese Academy of Science (SAJC201610).

ACKNOWLEDGMENTS

We would like to acknowledge University of China Academy of Science that give us any facilities and financial support to do this review paper and the researchers that did a lot and make their paper available online that help us to do this review paper as well as our great thanks also goes to the local community of the Yabello district for gave to us some basic information that are still the challenge for them for our next research step.

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Citation: Yong-dong, W. et al., (2018). *Assessment of Rangeland Management Approaches in Yabello: Implication for Improved Rangeland and Pastoralist Livelihoods. Review Paper. International Journal of Advanced Research in Botany (IJARB)*, 4(3), pp.16-25. <http://dx.doi.org/10.20431/2455-4316.0403002>

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