THE ECONOMICS OF
LAND DEGRADATION

An assessment of the economic impact of land degradation in Somaliland

SCIENTIFIC INTERIM REPORT

A case study of Baligubadle and Bookh rangelands

www.eld-initiative.org

Edited and coordinated by:
Mark Schauer (GIZ), Hanna Albrecht (GIZ)

Authors:
Mohamud Hussein, Lindsay Stringer, Martin Dallimer, Abdikarim Aden and Amuun Ali.

Contributors:
Hamda Ali Mohumad, Idiris Hashi Dharar, Muna Omer Abdillahi, Saam Ahmed Jama, Ahmed Hamud Migane and Cabdicasis Mohamed Elmi.

Visual concept:
MediaCompany, Bonn

Layout:
Additiv. Visuelle Kommunikation, Berlin

Photography:
Mohamud Hussein; Map in figure 1: bogdanserban - stock.adobe.com

Suggested citation:

Hussein, M.; Stringer, L.; Dallimer, M.; Aden, A.; and Ali, A. (2021). Economics of Land Degradation Initiative: An assessment of the economic impact of land degradation in Somaliland. GIZ: Bonn, Germany. Available from: **www.eld-initiative.org**

An assessment of the economic impact of land degradation in Somaliland

A case study of Baligubadle and Bookh rangelands

February 2021

www.eld-initiative.org

Executive summary

The overall objective of the study is to strengthen capacities of research and government institutions through training and mentoring on environmental valuation methods, so that the local decision makers are able to draw upon recommendations based on sound economic evidence. This is part of capacity building activities within the Regreening Africa project, jointly implemented by ELD initiative and the World Agroforestry Centre (ICRAF) (2017-2020). The ELD Initiative, in partnership with Agribusiness Solutions Hub, conducted training on the economic valuation of terrestrial ecosystems and their services. Training was complemented with practical exercises in the form of in-country research case studies.

This case study assesses the economic impact of land degradation on livelihoods of pastoral and agropastoral communities in Somaliland. It first establishes the extent of land degradation and drivers of recent land use change and then quantifies the impact of these changes on community livelihoods against the international poverty line. In consultation with local stakeholders, including relevant public institutions, researchers and communities, the research team identified Baligubadle and Bookh areas as suitable study sites. Although these sites currently generate significant flows of the ecosystem services, these are threatened by ongoing land degradation in the form severe loss of land cover resulting in soil erosion. The land degradation is being driven by extensive use rangeland enclosures (Baligubadle) and overgrazing, the effects of which have been worsened by frequent droughts linked to climate change. Lack of land tenure legislation and weak community governance systems have resulted in a loss of historical communal grazing rangelands. In turn this has led to over grazing of the remaining communal pasture.

The study adopts the methodological framework of the ELD Initiative. The ELD methodology is designed to guide users through the process of conducting scientifically sound cost-benefit analyses (CBA), based on the ELD 6+1 step approach (ELD Initiative, 2015). In line the with the ELD approach, the research team first established locations, spatial scales and a strategic focus of the study, based on an extensive review of available literature and consultations with relevant government officials and local research community stakeholders. The development of social capital arose from the capacity building aspect of the research and a preliminary field visit to one of the sites. Follow up field visits and further discussions with local communities living in the sites identified was carried out. Research was then undertaken to establish the geographic and ecological boundaries of the selected study sites, including close examination of both sites and aerial mapping (via drone footage) so as to assess the quantity, spatial distribution, and ecological characteristics of land cover types. This exercise allowed the research team to categorise the two study sites into distinct agro-ecological zones, with Baligubadle classed as a rangeland with mixed vegetation of grass, shrubs and tree cover, and Bookh as a hilly grassland with sparse shrubs and no tree cover.

Given the limited availability of relevant data and information, it was necessary to undertake focus group discussions (FGDs) with the local community leaders, pastoralists and agropastoralists, enclosure owners, village traders and rangers. FGD participants were selected in consultation with local community leaders and public officials. In addition, the research team undertook a consultation with local government officials and experts to help establish the links between the role of ecosystem services in the

livelihoods of local communities living in each land cover area and in overall economic development in the study zone. By understanding these issues, the research team was able to identify and collect relevant data to estimate the economic value of key ecosystem services.

A limitation of this study is that the analysis presented is partly based on a small amount of qualitative data collected through three FGDs and ad hoc discussions with local land use experts. There is little or no way to validate this information due to a lack of alternative data sources. We acknowledge that the assessment of environmental changes and their effect livelihoods is a complex task, especially in the context of a changing climate and an absence of previous research. In addition to the qualitative data from FGDs, extensive quantitative market and administrative data on prices for crops and livestock farming (i.e., inputs and outputs), and relevant environmental taxes and fines respectively, were also collected.

A CBA compared costs and benefits of two proposed management option against a counterfactual scenario or 'business-as-usual' (BAU) (i.e., what would happen in the absence of any intervention). The options considered would be expected to lead to positive net benefits over and above BAU. For Baligubadle, a registration of enclosures and designation of land for prescribed (agricultural or rangeland) use was proposed as a mitigating option to slow ongoing land degradation. For Bookh, a restoration intervention involving partial reseeding and soil bund construction was proposed as a mitigating option to slow ongoing land degradation.

A range of discount rates (3.5%, 5% and 10%) as adopted by previous ELD studies (Dallimer et al., 2018) were used for the CBA, together with two different time horizons (10 and 43 years) corresponding to the 2030 Agenda for Sustainable Development and the Africa (Developmental) Agenda 2063 respectively. The

evaluation of the land use options required the calculation of Net Present Value (NPV) and a benefit cost ratio (BCR) for each scenario considered. We note that this analysis only captures direct use values of the provisioning ecosystems services considered and there are other indirect use benefits (e.g., control of soil erosion) and non-use value (e.g. cultural and biodiversity) provided by rangelands that are not included in the analysis. A third scenario with a 20-year time horizon was also considered for each site to assess how our estimates are sensitive to changes in the discount rates applied and time horizon considered. Furthermore, estimates of the impact of benefits were assessed against existing estimates of poverty and vulnerability in the region to assess their potential effect on household income.

It is estimated that without intervention and therefore continuation of the current use enclosure (BAU), the NPV of the Baligubadle rangeland would likely be approx. USD 37 million over the 43 year (2063) time horizon, as measured in 2020 prices (Table 2). This amounts to USD 11,000 per household, or approx. USD 258 per household per each year or just USD 0.12 per person per day, assuming on average, households in the region comprise six people (World Bank, 2019). The BCR for the BAU scenario is 3, meaning that, for each three dollars of benefit generated, one dollar is spent to realise it. This suggests that, despite declining ecosystem services, overall, the pastoral and agropastoral livelihoods would remain viable under the BAU scenario although unfavourable events can easily reduce the benefits and/or increase costs to levels leading to further worsening of household livelihood. The registration option yields aggregate net benefits of USD 182 million, or roughly USD 55, 000 per household and therefore USD 1, 283 per household per year, amounting to a 400% increase compared to the corresponding BAU scenario. The high rate of improvement in NPV reflects both the potential protective effect of registration, leading to activities supporting the regeneration of land cover and therefore improved productivity over the 43 year time horizon. The BCR for the registration intervention option is 9, whilst the NPV per household and NPV per day per person increases from USD 258 and 0.12 to USD 1,258 to 0.59 respectively.

A similar picture emerges from CBA for the Bookh site (Table 3). Based on the 3.5% discount rate, the NPV improves by 60% from USD 64 million under the BAU scenario from 36.6 million to USD 102 million under restoration over a 47-year time horizon considered (note that the base year for Bookh analysis is 2017 when site surveying and restoration took place). The per household annual NPV increased from USD 541 to 868, corresponding to USD 0.25 and 0.40 per person per day respectively. The BCR also increased significantly from 5.7 to 9.8 respectively. The same figures for 10 years and 20 years range between 8.3 and 9.2 respectively under the different discount rates.

Regarding the policy implications, the CBA shows that land use interventions of the type examined can slow the ongoing land degradation in Baligubadle and yield significant net benefits. These results highlight the potential benefits that can be generated by the combined effects of the restoration work and the community-led management model. Importantly, these measures require a concerted effort by government, international programmes working in this area and the local communities affected, to ensure that there is a long-term and tailored site-specific approach to tackle land degradation and conserve ecosystem services underpinning the local livelihoods and economy. Specifically, there is the need for an effective legal framework for land tenure legislation, and greater administrative, technical and financial capability to enforce legislation to slow the land degradation through enhanced customary law-based land use management systems that have historically governed communal pastures like Bookh. Alongside this, well-planned transitioning of livelihoods from current mainly pastoral strategies toward more agropastoral activities with greater diversification of incomes and therefore a reduction in current land pressures from overgrazing in highly populated areas like Baligubadle, is necessary.

The study makes a useful contribution to the primary objective of building capacity in environmental valuation methods for use by local officials, and it also lays the foundation for future research in this area, which is crucially needed if the challenges of land use management in the face of climate change and social change are tos be effectively resolved.

Acronyms and abbreviations

BAU	Business-As-Usual
BCR	Benefit Cost Ratio
CBA	Cost-Benefit Analyses
ELD	Economics of Land Degradation
FAO	Food And Agriculture Organisation
FGD	Focus Group Discussions
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
ICRAF	World Agroforestry Centre
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
MoERD	Somaliland Ministry of Environment and Rural Development
NPV	Net Present Value
REG	Benefits of Land Registration
REST	Restoration
UNCCD	United Nations Convention to Combat Desertification
USD	United States Dollar

List of tables and figures

Table of contents

01 Introduction

Land degradation, as defined by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), refers to the many processes that drive the decline of biodiversity, ecosystem functions. or ecosystem services. It is typically a gradual degenerative process resulting from effects of combination of multiple factors, including climatic variations and human activities over many years (Olsson et al.,s 2019). In arid, semi-arid, and dry regions like Somaliland, land degradation leads to reduction or loss of the biological or economic productivity of rainfed and irrigated cropland, or range, pasture, forest, and woodlands as a result of land uses or other processes arising from human activities and habitation patterns, such as (i) soil erosion caused by wind and/ or water; (ii) deterioration of the physical, chemical, biological, or economic properties of soil; and (iii) long-term loss of natural vegetation' (UNCCD 1994, Article 1).

The range and intensity of desertification resulting from land degradation have increased in some dryland areas over the past several decades to extent that drylands currently cover about 46.2% of the global land area and are home to 3 billion people (Mirzabaev et al., 2019). Desertification and climate change, both individually and in combination, are also predicted to reduce the provision of dryland ecosystem services and lower ecosystem health, including losses in biodiversity. The impact of land degradation on livelihoods is therefore associated with the declining status of natural resources, often as a result of unsustainable overexploitation and deteriorating climatic conditions. In this regard, land degradation can be viewed as any undesirable change or disturbance to land driven largely by human activities like agriculture, land use conversion and growing human settlements (Eswaran, et al., 2001). The negative environmental change accelerated by human activity ultimately lowers the productive capacity of land leading to significant loss of income and livelihoods around the world.

The Horn of Africa is particularly severely affected by the combination of effects of changing climate and unsustainable land-use practices (Prescope et al., 2013), the impacts of which are predicted to increase in the future. The IPCC's Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (2012) indicates that there will likely be more heavy rainfall over the region with high certainty and more extremely wet days by the mid-21st century. There will also likely be an increase in the frequency of hot days in the future, although a decreasing drying trend over large areas is also projected. Increasing climate variability and extreme weather conditions, along with declining trends in rainfall and rising temperatures, represent major risk factors affecting agricultural production and food security in the region. Livestock productivity is in particular severely impacted as the rangelands of Ethiopia, Kenya, and Somalia have been subject to overgrazing over the past three decades. Livelihoods largely remain predominantly dependent on pastoralist and agro-pastoralist activities, whilst at the same time these countries have experienced substantial increases in human populations.

If government departments and local leaders are to tackle the challenges associated with land degradation, then it is essentially that they are

appropriately trained. Thus, the objective of this study and the case study presented, is to strengthen capacities of research and government institutions through training and mentoring on environmental valuation methods, so that local decision makers are able to draw upon recommendations based on sound economic evidence. As part of this process, 12 local officials and researchers were trained by ELD experts from the University of Leeds, UK and subsequently a local consultant, using class-based learning methods. The team were then coached through all steps of a research project design including concept note development, data collection, data entry and analysis. The resulting case study assesses the effects of land degradation on livelihoods of pastoral and agropastoral communities in Somaliland. To achieve this the study began by establishing the extent of land degradation and drivers of recent land use change in the study areas. It then quantified the impact of potential policy interventions assessing the effect on community livelihoods against the international benchmark poverty level.

The case study examined two regions in Somaliland: Baligubadle and Bookh. In Somaliland, around 85% of the population make a living from extensive livestock production systems, either exclusively (pastoral livelihoods) or in combination with seasonal arable farming (agropastoral livelihoods) (GIZ, Sustainable land management in Somaliland, 2015-2019). Land degradation and resulting losses of livestock and crop productivity, threaten these livelihoods, in particular in the context of the reoccurring droughts linked to climate change. The most prevalent degradation types in the region are loss of topsoil by wind and water erosion, often resulting in the formation of gullies, reductions in vegetation cover, land salinization and a decline in indigenous plant species and spread of invasive species such as Prosopis juliflora (FAO, 2009). The main causes of land degradation include a significant increase in human and livestock populations as well as widespread poverty under weak environmental governance leading to the emergence of private enclosures in the common grazing rangelands (e.g. Baligubadle) and overgrazing (e.g. Bookh). Due to the absence of effective environmental regulation and enforcement, alongside the weakening of the traditional community-based pasture governance systems, known as Xeer, the private enclosures now create considerable pressures on the remaining limited common grazing areas. Overgrazing has already caused severe land degradation in Baligubadle and Bookh, and until now there has been only limited public or community awareness and effort to avert the trend. Due to their gradual and subtle nature in the initial stages, these environmental changes can go unnoticed for long periods (FAO, 2009). Observable features such as gully erosion, the spread of exotic invasive plant species, and poor livestock and crop productivity due to agriculturally 'exhausted' soil manifest themselves in later stages of land degradation when corrective actions to slow down degradation or reverse can be difficult and often more costly than would be the case if early action had been taken.

Greater community awareness and effective public policy measures are needed to mitigate the situation, and specifically to develop relevant policy and regulation, as well as building sufficient enforcement capacity to reduce the current rate of degradation and gradually restore the lost ecosystem services. This effort is particularly critical to safeguarding the sustainability of the pastoral production system which underpins the local economy and livelihoods of local communities. Indeed, live animal exports are vital to Somaliland's economy, contributing 85% of export earnings and 30% of Gross Domestic Product (GDP), and directly and indirectly employing 70% of the population (Musa et al., 2020). On that basis, poverty reduction through recovery and resilience building measures supporting economic growth to generate employment and prosperity is the main focus of local developmental strategies (e.g. Somaliland Development Plan II, 2017).[1] This is especially important for nomadic (pastoral) and rural (agropastoral) communities who are the poorest groups in Somali society, alongside those living in internally displaced centres across the country as a result of the reoccurring natural terl war.

[1] The international poverty line was introduced in the 1990 World Development Report with the aim of measuring poverty consistently across countries. According to the World Bank Somalia Poverty and Vulnerability Assessment (2019), almost 7 in 10 Somalis live below the international poverty line of $1.9 as measured using purchasing power parity of 2011, a metric used to compare different countries' living standards through a "basket of goods" approach.

02 Identification of the main drivers of degradation

In consultation with local stakeholders, including relevant public institutions, researchers and communities, the research team identified Baligubadle and Bookh as suitable study sites. These sites currently generate significant flows of the ecosystem services threatened by ongoing land degradation. Broadly speaking, ecosystem services from these sites are the benefits that society receives from nature, including the regulation of climate, the pollination of crops, the provisioning of cultural and recreational environment, as well as many essential goods such as food, fiber, and wood (Sala et al., 2017). In this study, we focus on the provisioning services, including livestock grazing, subsistence farming, wild foods and medicinal plants, building material, firewood, charcoal (commercial). However, we also recognise the importance of cultural services to communities in the form of nomadic and semi-nomadic tradition and attachment to an ancestral lifestyle and place for local communities, even though these were not included in the analysis.

The speed with which the ongoing land degradation is progressing outpaces the inherent natural regenerative capacity of these ecosystems. Somaliland, which lies in an arid and semi-arid environment, is in particular, experiencing recurrent episodes of drought that are increasingly becoming serious natural hazards. Indeed, it is estimated that in some areas of Somaliland that pastoral households have lost up to 60% of their livestock herds during the last major cycle of drought in 2016-2017 (FAO, 2019). With the high losses of livelihood assets and sources of nutrition, many rural households are either forced to explore unsustainable alternative income sources such tree cutting for charcoal production, or they migrate to the nearest villages, towns or Internally Displaced People (IDP) camps to access humanitarian assistance (Bolognesi and Leonardi, 2018; DINA Report, 2018).

Some natural causes such as terrain, slope, and soil vulnerability to water and wind erosion also influence the degradation processes, whilst human activities such as farming and livestock grazing, affect the speed with which land degrades. Other important drivers of land use change are linked to the weakening of traditional social governance alongside the absence of government regulation. During the civil war in the late 1980s, which culminated with a total collapse of public institutions, including the Central Rangeland Management Agency, many people in Somaliland were displaced and fled to Ethiopia. On returning after the war from in the early 1990s, profound sociopolitical 10 changes resulted, which among others, included the emergence of less sustainable land use trends such as increased charcoal production and acceleration of land enclosure. People started to make claims on large plots of land in communal grazing rangeland areas, often erecting barriers, an activity involving the cutting of substantial amount of Acacia trees to be used as fencing material as is the case in Baligubadle. In other areas of the region, such as Bookh, declining land cover from overgrazing led to severe land degradation over time.

The implications of these practices are: (a) the natural habitat and land cover has been modified drastically, leading to significant increases in wind and water erosion; and (b) the total area of pasture available for common grazing has been reduced considerably, creating excessive grazing pressures on the remaining communal area, therefore resulting in declining animal productivity, household income reductions and food insecurity. The claims of private land en-

closure ownership have in particular eroded the centuries-old traditional Xeer-based approach to pasture management by Somali nomads. This traditional customary law system, which is still in use in Somaliland today albeit in a weakened form, governs all social relations between communities, such as conflicts, resource sharing, and the provision of the rule of law, through the customary laws (Venema, 2009). The Xeer has socially binding rules for the sharing of pastures, water, and other natural resources. Every member of the clan and other migratory visiting nomadic households have the right of access to the rangelands and water resources of the territory inhabited. By laying a claim on common grazing and therefore restricting use, owners of enclosures violate the Xeer. A lack of effective local environmental regulation and enforcement capacity at a local level to ban or limit such unsustainable practices increasingly push a large number of livestock to the limited surrounding communal grazing areas.

03 Description of study sites

3.1 Baligubadle site

Baligubadle site is located in the southern Maroodi Jeex region, Somaliland (Figure 1). The nearest main town, Baligubadle, which straddles the border between Somaliland and Ethiopia, is located at a latitude of 9.265266 and longitude of 43.961170. The town has a total population of about 18,000 people, and a further 3,300 households reside in rural areas of the district between Gumburaha village and Baligubadle town along the Somaliland side of the border. The site of 11 interest to this study is within the rural area, which is approximately 12 km2, and populated by a mix of pastoral and agropastoral households. Livelihoods are predominantly dependent on livestock and crop production for both income and nutrition.

Land use practices in the area have shifted from the historical tenure policy under three land use designations of agricultural, forestry and common grazing land, to illegal enclosure of land, where, in the absence of new policy, people fenced off much of rangeland for private use preventing access for communal livestock grazing and other uses. In the past, the rangelands were either held under a communal system based on customary rights in the traditional clan-based land ownership system in which land was considered to 'belong' to local clan dwellers although there was no formal title deed. This system did not delimit land for any specific tribe use but rather implicitly recognized the primacy of rights of largest resident clan(s) in the area and also protected the rights to pasture and passage of other clans through customary rules that obliged the resident clan (s) to protect life and property of migratory herders in their territory. Much of the land within the Baligubadle site was historically used for livestock production or mixed crop production although the latter was limited to areas legally designated for agricultural use.

More importantly, land enclosures were neither socially acceptable nor legally permitted under the customary rules, and households of the local clans and other 'non-resident' clans, including migratory herders, were able to use land for grazing without hinderance. As such, the nomadic pastoralists populating the area and its surroundings were able to move their livestock around throughout the year in search of suitable water and pasture. Overgrazing in any particular area was uncommon. Typically, local pastoralists travelled a long distance or crossed the borders to access water and pasture available elsewhere in the dry seasons if necessary. In this setting, the extent of grazing in the site area was mostly determined by the availability of pasture and water, and the presence or absence of biting insects and ticks.

3.1.1 Current land use practices

At present, there is no land tenure law governing land use and existing customary rules are too weak to safeguard pastureland. As a result, there has been widespread use of enclosures across the region, including in Baligubadle. On the other hand, frequent droughts linked to climate change and social changes in the past three decades have forced a major shift in rural household livelihood strategies from traditional pastoralism toward a more sedentary semi-nomadic strategy, with the expansion of existing village centres and the emergence of new ones over the past 30 years. Interviews with local administrative officials indicated that there are 900 pastoralists (27%), 700agro-pastoralists

FIGURE 1

Location of study site

(21%) and 1700 (51%) resident households living in the area. A significant number of these rural households are increasingly engaged in economic activities linked to rural villages and nearby towns or cities, including trade of livestock and agricultural produce and casual labour, alongside pastoralist or agropastoralist activities. Improved transport and telecommunication, including advances in mobile money technologies, have recently increased connectivity between rural and urban centres and beyond, and have facilitated rapid social changes.

3.1.2 Impact of land enclosures

A large proportion of the local population now reside in a single location throughout the year regardless of whether they own an enclosure. This is partly due to the impact of reoccurring droughts that, over time, have reduced average household livestock herd size and made households more vulnerable to shocks. This, together with semi-urbanisation resulting from land enclosures, has made them less inclined to move away from areas where they can access external assistance (e.g. food aid) or alternative livelihood opportunities (Figure 2). The study area is now characterized by extensive private enclosures of historically common grazing rangelands. The mapping undertaken concluded that there is only about 3.6 km2 of the original rangeland area (or roughly 30%) that remains available for common grazing. Most of the pastoral households increasingly rely on this limited rangeland throughout the whole year. The area is also one of the main livestock migration routes to the Hargeisa markets or the port of Berbera, especially during the export season when hundreds of thousands of animals from the Ethiopian side of the border may go through the area within a period of about 4-6 weeks. Discussions with the local community and experts hinted that a further complicating factor is an increased trend in the sales of enclosure land to wealthy business people from neighboring cities, who often do not use land as a productive asset but rather as investment or "weekend leisure ground".

Consequently, the remaining common rangeland has degraded severely due to overgrazing and gradual desertification over the past three decades. The private enclosures are instead used for subsistence farming and grazing by livestock

FIGURE 2

Private enclosures in Baligubadle rangelands

of the individual owners, some of whom also produce significant charcoal and firewood from tree cutting. The fencing built around these enclosures to control access is from local Acacia trees, a practice that on its own has led to a significant loss of land cover and severe soil erosion, alongside unsustainable charcoal production. Some owners also rent their enclosures seasonally to other local herders and livestock traders for temporary grazing although this is not common at present. Furthermore, there is a little evidence of commercial hay or fodder production, so most of the land under these enclosures is underutilized for grazing but overexploited for other uses.

3.2 Bookh site

Bookh is located 20 km northwest of Go'a District in the eastern plains of Gacaan Libaax Mountain, Somaliland. The Bookh valley is a large water catchment with a main rangeland area supporting livelihoods of local pastoral and agropastoral communities. The valley ends at the Tog Gal Cad, a major seasonal watercourse running along the Golis Mountains to the east. The Tog is a main contributory of Togdheer seasonal river that cuts through a large of swathe of territory in Togdheer region and then Nugal valley before reaching the Indian Ocean. The Bookh valley's approximate central point coordinates are Latitude: 9.8708 and Longitude: 44.93564, and it covers a total area of about 17 km2, or 1730 ha.

The Bookh valley, characterised by grass and sparse shrub vegetation on gentle sloped hillsides and a middle flat strip of land with rich alluvial soils, has been subject to significant soil erosion due to declining land cover resulting from gradual deforestation and overgrazing over the past three decades. Historically, most of this area was part of a buffer zone for a large protected national grazing reserve covering both valley grasslands and surrounding forested areas. This reserve was opened for communal grazing only in severely dry years

when there was little or no alternative pasture available in the region. However, this rangeland management practice stopped with the collapse of Somalia's central state in 1990. Since then, the Bookh valley site has been used as an open all-season grazing area by local and surrounding communities. The resulting unregulated common grazing often led to a high density of livestock, with animals exceeding the site's carrying capacity in most seasons. The protracted overgrazing in turn resulted in the severe loss of land cover, soil compaction and erosion, leading to a gradual desertification and formation of gullies over the decades. Frequently reoccurring droughts with increasing intensity have exaggerated the situation, as recovery of the vegetation is limited under these circumstances. In a survey conducted by the Somaliland Ministry of Environment and Rural Development (MoERD) in 2016 to evaluate the extent of land degradation in Bookh, 265 ha (15%), 586 ha (34%) and 878 (51%) of the valley were classed as strongly, moderately or slightly degraded respectively.

Several projects led by local and international non-governmental organizations have attempted to slow the land degradation over the past two decades. However, the effects of the measures adopted were not sufficient to reduce the accelerated desertification and erosion (Figure 3). Estimates from site mapping and personal communications with the local rangers at the site concluded that the gullies now occupy roughly 7% of the total area of the valley, or 120 ha of prime rangeland in the bottom of the valley, in areas with the deposited alluvial soils. According to the senior rangers, the projected degradation trend is for continued gully formation with an estimated 5% annual rate of expansion of eroded land (circa 6 ha) without any effective intervention measures to halt or reduce significantly the desertification and resulting soil erosion.

FIGURE 3

Gully formation in Bookh reserve

CHAPTER

04 Methodology

The study adopts the methodological framework of the ELD Initiative which is designed to guide users through the process of conducting scientifically sound cost-benefit analyses, based on the ELD 6+1 step approach (ELD Initiative, 2015). The research team first established the scope, locations, spatial scale, and strategic focus of the study, based on a literature review, stakeholder consultations and a field visit. Follow up field visits and discussions with local communities and experts were then carried out to establish the geographic and ecological boundaries of the study sites, including close examination of both sites by aerial drone footage, which yielded an assessment of quantity, spatial distribution, and ecological characteristics of land cover types. An overview of the land cover types allowed us to categorise the two study sites into distinct agroecological zones.

FGDs with the local community leaders, livestock and crop producers, and rangers (Figure 4), as well as consultations with local government officials and experts were conducted to establish the links between the role of ecosystem services in the livelihoods of local communities living in each land cover area and in the overall economic development of the study

FIGURE 4

Focus group discussion

zone. This information informed the development of scenarios to address land degradation. In addition, market and administrative data on prices for crop and livestock input and output, and relevant environmental taxes and fines were collected.

Finally, CBA comparing the NPV of each identified land management option against a corresponding 'business-as-usual' (BAU) scenario (that is, what would have happened in the absence of any intervention) was carried out to assess whether the land management changes could lead to positive net benefits. Discount rates of 3.5, 5% and 10%, as adopted in previous ELD studies (Dallimer et al., 2018) were used, considering, considering two different time horizons (10 and 43 years) corresponding to 2030 Agenda for Sustainable Development and Africa's (Developmental) Agenda 2063 to calculate a Net Present Value (NPV) and benefit cost ratio (BCR) for each scenario. We also included a third time horizon (20 years) to assess the extent to which changes in the discount rates and time horizon affect the NPVs. Furthermore, considering the widespread poverty in Somalia and primacy of its eradication in local public policymaking, results from the CBA were then considered in the context of country poverty analyses. For this aspect, we calculated an aggregate of net benefits accruing to a household over the different time horizons considered i.e., annual benefits by household, and daily net benefits per person with that household as compared to international poverty level of $1.9.

4.1 Registration of enclosures for Baligubadle

The main ecosystem services identified in Baligubadle are forage, food and feed production from farming, fuelwood for charcoal production, firewood for domestic cooking and sale and building material for construction of traditional houses. The Government of Somaliland has tried to dismantle the private enclosures in the study site in the past. For example, 340 enclosures within the area historically designated as rangelands were destroyed in 2014. However, in many cases, the owners of these enclosures have re-established their fences, and more worryingly, increased the size of their enclosures in the 2-4 years since their original removal. In the absence of a local land tenure policy and an enabling legal framework for enforcement, it has been difficult to permanently remove enclosures. A different approach is needed to mitigate the impact of the ongoing land degradation. Further, the increase in village settlements with more diversified rural livelihood strategies at a household level suggests that the removal of the enclosures is unlikely to encourage a full return to traditional pastoralist land use practices. Given the increasing climate change impact, encouraging pastoralists to return to traditional practices could expose them to higher risks and keep them in poverty.

On that basis, the registration of the existing enclosures under the old (Somalia[2]) land use designations is deemed to be a more practical approach to address the problem. This option envisages: (a) compulsory registration of all existing enclosures within specified timescales, or transfer of their ownership to government; (b) restriction of land use, limiting it to activities permitted under the designated use only; and (c) stipulation of new administrative procedures for land taxation and imposition of fines and prosecution for breaches of designated uses. The goal is to encourage more sustainable land management by limiting charcoal production, facilitating commercial grazing practices and good agricultural practices to generate greater incomes, whilst at the same time supporting more equitable access to pasture among local communities. Registration internalizes the externalities of enclosure use through the legal allocation of property rights, improving the sustainability of ecosystem service flows from the rangelands.

In this setting, we assess the impacts of a management option involving: (a) registration of all existing enclosures, (b) restriction of land use based on historic designation, (c) taxation of the land by hectarage, and (d) introduction of tougher measures for charcoal production in situ, including fines and use of less costly tree count methods using GIS technologies. This is compared with the BAU scenario of continued use of enclosures across the different time horizons and discount rates.

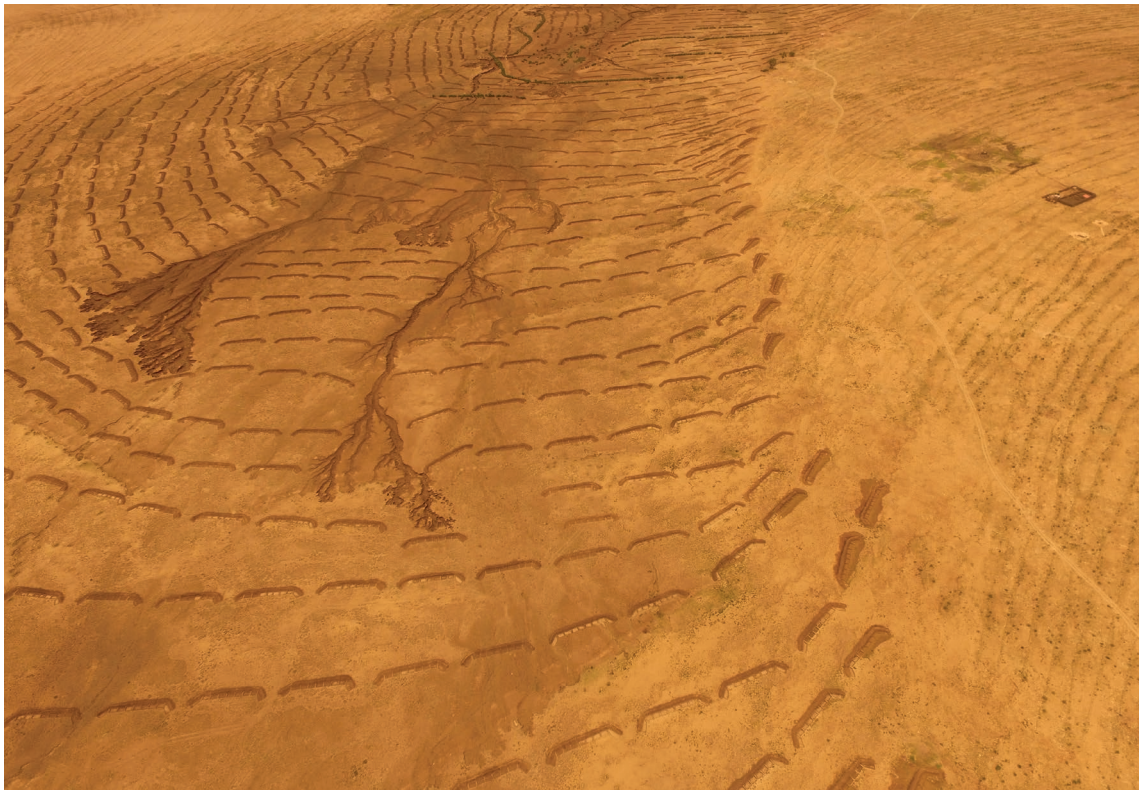
4.2 Restoration and maintenance of Bookh site

The main ecosystem service on the Bookh site is forage for grazing, mostly sheep but also goat and camel browsing of sparse shrubs. To reduce desertification and soil erosion, in 2016 the MoERD implemented a restoration project in 400 ha located on the steepest sloping areas of the site where soil erosion is progressing at its highest pace. This involved (a) the construction of soil bunds to slow the water runoff, (b) construction of check dams in gullies to reduce the rate of expansion, (c) reseeding of grass species to reinvigorate or restore lost vegetation, and (d) the creation of a Community Rangeland Management Organization to manage the communal grazing area more sustainably. The project has contracted an engineering company which mobilised the local community to construct soil bunds in the areas most prone to erosion. These soil bunds, which were built in concentric semi-circles distanced by 60m, are partly designed to hold water and partly to slow runoff water on slopes with a gradient of five degrees or more. Each soil bund is roughly 24m long, 1m deep and distanced 15 m from the bunds within the same concentric circle (Figure 5). Stones were used by previous projects to create similar concentric lines to slow the runoff from other hills with gentler gradient slopes.

The project has also reseeded using indigenous grass species found to restore vegetation cover effectively, including Dixi (Sporobolus marginatus), Garagaro (Echinchloa colna) and Dareen (Chrysopogon aucheri). In addition to being palatable grasses, these species have vigorous foliar and root systems that can protect soil from rain impact and runoff. The project has also stipulated an agreement with the local community who assumed overall responsibility to manage grazing throughout the year. Under the agreement, the local community committee sits two or three times a year, excluding emergency meetings, to approve a list of conditions to be 18 guaranteed/safeguarded. Issues discussed include rights of local households and

FIGURE 5

Construction of soil bunds

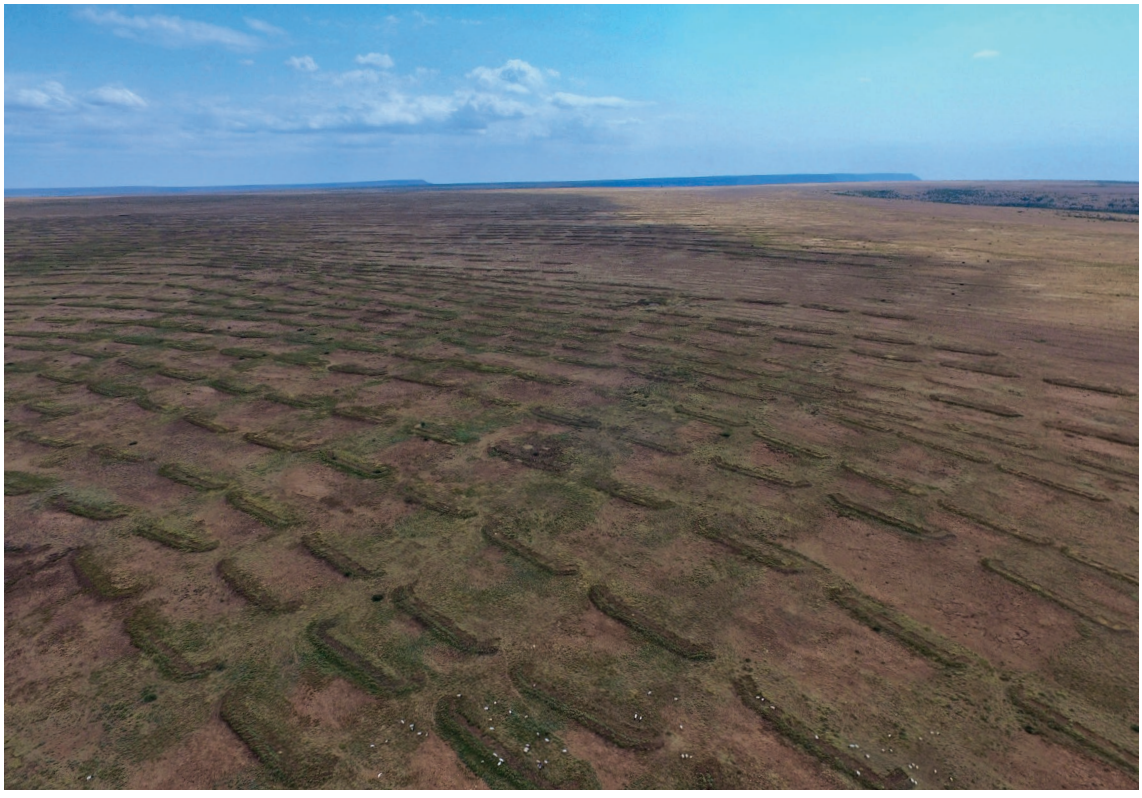


surrounding communities to graze their livestock and use the grazing reserve for non-commercial purposes, access and right of way of people and livestock to water sources, and use of public utilities passing through the Bookh rangeland reserve, such as roads, marketplaces etc. Despite the continuing open grazing all year around, observations made during our study site visit in August 2020 indicated the area has already shown remarkable signs of recovery (Figure 6). The combination of soil bunds, reseeding and reduced livestock density under the community management model have allowed significant recovery of vegetation cover and a slowing down of gully progression.

In this site, the CBA assesses the impact of the restoration intervention against the continued historic open and unregulated pasture system (BAU). It first established a base year for BAU, 2016, when the site was first surveyed for the restoration intervention, and evaluated the impact of the latter against the BAU scenario over 43 (to 2063), 10 years (to 2030) and 20 years respectively.

FIGURE 6

Restored vegetation after 4 years



05 Assumptions for scenarios

Table 1 provides a summary of the assumptions developed for both Bookh and Baligubadle sites. These were informed by two discussions with local officials, rangers, elders and experts from 24th August to 25th August 2020. Each FGD involved between eight and ten people. The unabated land degradation is expected to result a significant decline of ecosystem services under the BAU scenarios. However, the benefits of land registration (REG) and restoration (REST) efforts are expected to be modest and only likely to materialize slowly given the existing high levels of land use pressures, weak environmental governance systems, high population growth, as well as the predicted higher temperatures associated with climate change in the Horn of Africa.

TABLE 1

Assumptions for scenarios

	Ecosystem service	Description	Scenario	Predicted annual change
Baligubadle	Charcoal	Pyrolysis production from tree cutting, sold in town and cities	BAU	1% increase in production under weak enforcement capacity. Cost of production will increase by 0.5% due to declining number of older trees used for production
	Agricultural production	Subsistence horticultural and cereal (maize and sorghum) farming	BAU	0.5% increase. There is likely a gradual shift toward more agricultural activities as livestock production declines. Cost of inputs will increase with activities by 0.5%.
	Grazing production	Grass pasture and shrub and tree browsing	BAU	1% decline due to decreasing availability of pasture. Given the open pasture rangeland there is no cost association with production
	Livestock production	Sale of live animals, milk, meat, butter/ghee, hides and skin for both own consumption and sale	BAU	1% decline meat, milk and fat production due to declining pasture, whilst the cost of husbandry is likely to remain unchanged due to higher effort required to rear the same number of animals.
	Firewood	Dry wood and biomass for home cooking and sale	BAU	0.03% increase to keep up with growing demand from population growth. Cost of firewood collection is likely to increase by 0.05% as land cover declines.
	Building material	Poles, grass, weaving and fencing materials	BAU	0.5% decline due to vegetation cover. The cost will increase due to material and declining incomes (and therefore access to alternative building material) and also increasing demand from population growth
	Charcoal	Pyrolysis production from tree cutting, sold in town and cities	REG	1.5% decline due to tree registration and fines imposed. This will result in 1.7% increase of cost production, leading gradual switching to agricultural production and use enclosures for rental grazing.
	Agricultural production	Subsistence horticultural and cereal (maize and sorghum) farming	REG	0.8% increase in output and 0.5% increase in input cost due to higher demand.
	Grazing production	Grass pasture and shrub and tree browsing	REG	0.5% increase in pasture output with no associated cost at household level. However, administrative costs associated with rangeland management option, accounted under the charcoal costs.
	Livestock production	Sale of live animals, milk, meat, butter/ghee, hides and skin for both own consumption and sale	REG	0.7% increase in livestock productivity associated with 0.7% increase of animal husbandry costs because of the greater (extensive grazing, i.e. non-input saving growth) effort involved in nomadic production systems.
	Firewood	Dry wood and biomass for home cooking and sale	REG	0.3% increase in output and 0.5% increase in firewood effort (cost) due to restriction on tree cutting and therefore limited sources of dry biomass which is partly from charcoal tree felling activities and partly from natural decay of trees.
	Building material	Poles, grass, weaving and fencing materials	REG	0.5% increase in output, with associated 0.5% increase of household labour cost given non-input saving (i.e. collection effort) saving output growth. In effect, the manual collection effort increases with availability of building material.
Bookh	Grazing production	Grass and shrub browsing	BAU	1.5% decline in pasture output associated with 1.5% animal husbandry cost increase
	Grazing production	Grass and shrub browsing	REST.	2% grass regeneration rate associated with 1% increase in costs. There is a relatively small (10k) reoccurring annual cost associated with the maintenance and reseeding

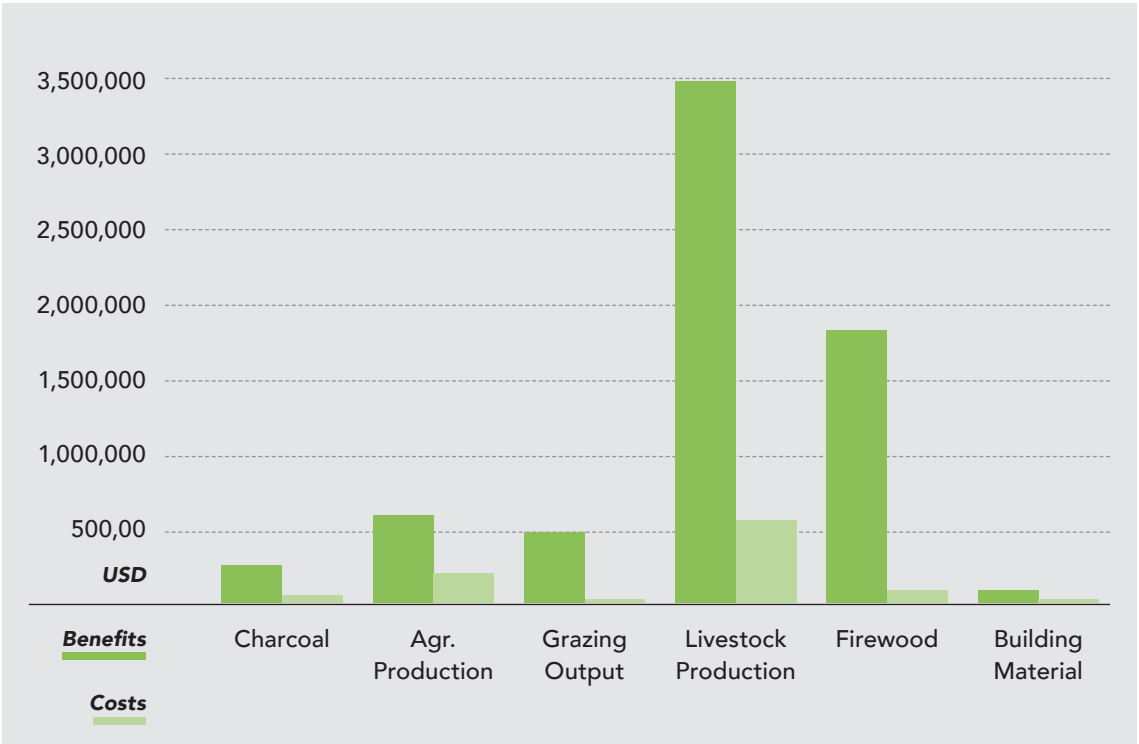
06 Data

Data collected came from FGDs, market prices, and administrative sources. Tables 3 and 4 summarise the data collected for Baligubadle and Bookh sites respectively; see also Annex 1. It is worth pointing out that this analysis captures direct use values of the provisioning services ecosystems services considered which include charcoal, grazing and resulting animal production, agricultural production, firewood and building material. There are other indirect use benefits (e.g. control of soil erosion) and non-use values (e.g. cultural and biodiversity) provided by rangelands, but they are outside the scope of this study.

Descriptive analysis of the data shows that for Baligubadle, animal production in the form of live animals, meat, milk, milk derivatives, skins and hides (some of which are sold, some used for household consumption), accounts for 50% of total benefits and 62% of household total production costs. Calculations are based on average household consumption, aggregated to calculate the community-level consumption. Grazing value is calculated using site carrying capacity, total livestock population figures and opportunity costs of pasture, as measured by the value ofcommercial fodder at valued at local market prices. Household labour costs are

FIGURE 7

Baligubdle, annual benefits and costs (USD), 2020



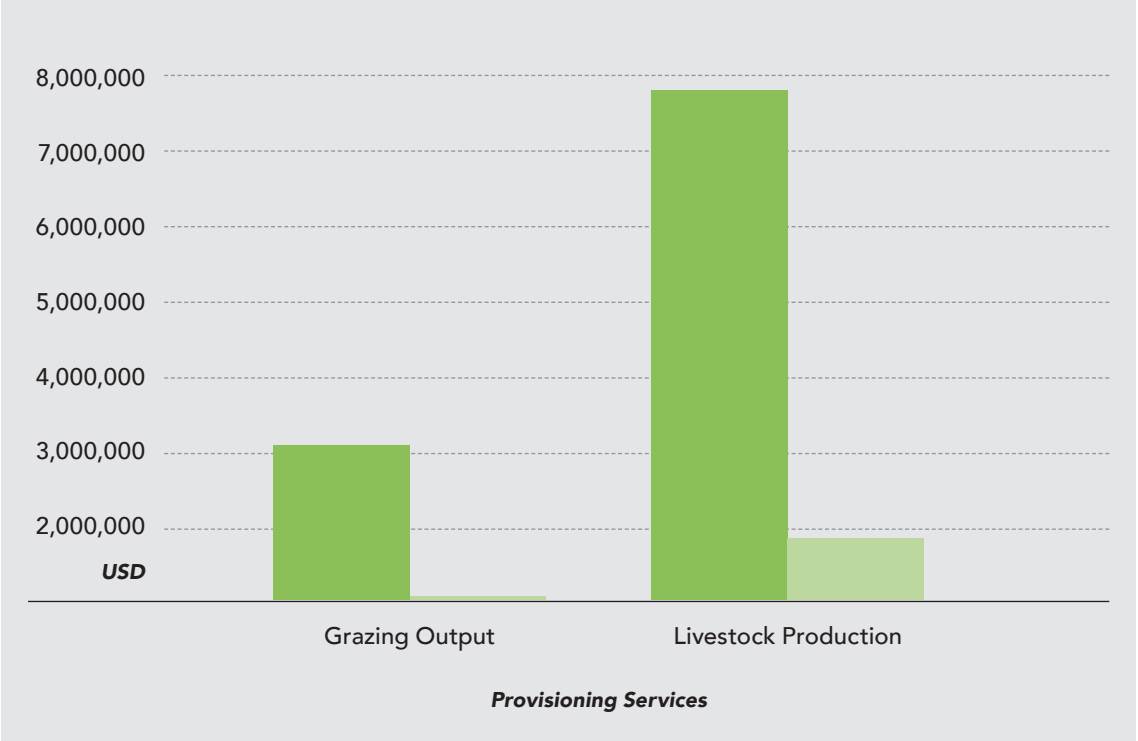
at the rate closest local wages. In the absence of official statistics, qualitative data from FGDs has been used to estimate average household consumption, agricultural output, size of livestock herds and associated husbandry costs.

Firewood, which is typically utilized to provide energy for cooking, heating and lighting in rural household with no access to electricity, accounts for 27% of benefits but only 7% of the household production cost. In contrast, subsistence agriculture accounts for only 10% of the total benefits but 27% of the total production cost because of the high cost of seeds (horticulture) and tractor services, as well as transport for marketing of produce due to poor rural infrastructure. Limited skills and scarcity of irrigation water are additional limiting factors for agricultural productivity. The calculation of agricultural production value and input is based on average household output/input per hectare output valued at local market prices, aggregated to total community output/input. For an overall summary see Figure 7.

Bookh site generates USD 7.3 million and 2.5 million of benefits through grazing and livestock production based on nomadic (pastoral) production systems respectively, whilst the animal husbandry labour accounts for all household production costs under the current open grazing system (see Figure 8). Given the dominant grassland feature, the site does not generate any other significant benefits. Agriculture practiced within the site is negligible and the sparse shrubs are not suitable for production of charcoal, firewood or building material. The per household annual benefits are roughly twice (USD 3,944) those of Baligubadle because of lower density of population and higher animal productivity in Bookh.

FIGURE 8

Bookh, annual benefits and costs (USD), 2016



07 Findings

Table 2 summarises the key findings for Baligubadle, whilst the results for Bookh are summarized in Table 3. The main findings for Baligubadle are that without any intervention, continued use of private enclosures will reduce the benefits to the local community because of shrinking communal grazing land, continued underutilization and charcoal production, compared to the enclosure registration option.

We first present in detail the results for the BAU option based on a discount rate of 3.5% and 43 year time horizon, and then provide an overview how these figures change when the 5% and 10% discounted applied to 10 and 20 year time horizons. The same is presented next for the registration option to facilitate a comparative analysis of the NPVs of two scenarios across the different discount rates and time horizons. It is estimated that without intervention and therefore continuation of the current use enclosure (BAU), the NPV of the Baligubadle rangeland would likely be approximately USD 37 million over the 43 year (2063) time horizon, as measured in 2020 prices. This amounts to USD 11,000 per household, or approx. USD 258 per household per each year or just USD 0.12 per person per day, assuming on average, households in the region comprise 6 people (World Bank, 2019). The per person per day NPV value of 0.12 is just 6.3% of income ($1.90) which reflect the line below which a person's minimum nutritional, clothing, and shelter needs cannot be met in a poor country like Somalia. However, it is worth recognizing that poverty extends beyond lack of money to non-monetary deprivations across multiple dimensions. Nevertheless, the assessment of NPVs accruing to an individual within a pastoral and agropastoral as a measure of attainable living standards is an important as aspect of valuation of rangeland ecosystem services as most rural households depend entirely on livestock production for both income and nutrition. In addition to monetary poverty, most Somali households suffer other nonmonetary deprivations (World Bank, 2019). Almost 9 out of 10 Somali households are deprived in at least one dimension: monetary, electricity, education, or water and sanitation. Nearly 7 out of 10 households suffer in two or more dimensions. Pastoral and agropastoral populations suffer the most because of their low levels of wealth and assets to cushion against, for example, climate and market shocks negatively impacting on their living standards compared to urban dwellers.

A discount rate 4-year average of reported annual inflation (9.15%) is used for all scenarios to adjust the value for effect of inflation, in terms of loss of purchasing power of money over the time horizons considered. The BCR for the BAU scenario is 3, meaning that, for each three dollars of benefit generated, one dollar is spent to realise it. This suggests that, despite declining ecosystem services, overall, the pastoral and agropastoral livelihoods would remain viable under the BAU scenario although unfavourable events can easily reduce the benefits and/or increase costs to levels leading to further worsening of household livelihoods. Droughts leading to loss of livestock and/or low animal weight, animal disease outbreaks and associated livestock export bans can all have immediate and dramatic impacts on living standards of the pastoral and agropastoral communities (FAO and World Bank, 2018; World Bank, 2018).

At 5% and 10% discount rates, the BAU benefits decline to 35 million and 29 million respectively. However, the BCRs increase from 3 to 4 and 5 respectively. This due to the relatively greater effects of increasing discount rates on the larger

benefit figures compared to costs. In contrast, the per year NPV, annual NPV and per person per day NPV have all declined.

Based on 3.5% and 43 year time horizon, the registration option yields aggregate net benefits of USD 182 million, or roughly USD 55, 000 per household and therefore USD 1, 283 per household per year, amounting to a 403% increase compared to the corresponding BAU scenario. The high rate of improvement in NPV reflects both the potential protective effect of registration, leading activities supporting the regeneration of land cover and therefore improved productivity over the 43 year time horizon. The BCR for the registration intervention option is 9, whilst the NPV per household and NPV per day per person increase from USD 258 and 0.12 to USD 1,258 to 0.59 respectively.

With regard to sensitivity analysis, the BCRs for 10 and 20 years, which used 3.5%, 5% and 10% discount rates respectively, range between 6 and 7. However, the effect of the high the discount rates on NPV is noticeable even over the shorter time horizons, with per household, annual NPV and NPV per day per person figures all declining in magnitude over time. It is worth noting that additional costs associated with the mitigation measures under the registration option across different scenarios are captured in the analysis.

A similar picture emerges from CBA for the Bookh site (Table 3). Based on the 3.5% discount rate, the NPV improves by 60% from USD 64 million under the BAU scenario to USD 102 million under restoration over a 47-year time horizon considered (note that the base year for Bookh analysis is 2017 when site surveying and restoration took place). The per household annual NPV increased from USD 541 to 868, corresponding to USD 0.25 and 0.40 per person per day respectively which are just 13% and 21% of

TABLE 2

Benefits of scenarios across different discount rates and time horizons (Baligubadle)

Scenario	Aggregate NPV	BCR	Aggregate NPV per HH	Annual NPV per HH	NPV per person per day
BAU @ 43yrs and 3.5%	36,613,326	3	11,095	258	0.12
BAU @ 43yrs and 5%	34,722,520	4	10,522	245	0.11
BAU @ 43yrs and 10%	29,146,074	5	8,832	205	0.09
REG. @ 43yrs and 3.5%	182,047,131	9	55,166	1,283	0.59
REG. @ 43yrs and 5%	119,343,405	6	36,165	841	0.38
REG. @ 43yrs and 10%	50,500,908	6	15,303	356	0.16
REG. @ 20yrs and 3.5%	56,319,808	7	17,067	853	0.39
REG. @ 20yrs and 5%	49,642,488	6	15,043	752	0.34
REG. @ 20yrs and 10%	36,973,587	6	11,204	560	0.26
REG. @ 10yrs and 3.5%	38,170,190	6	11,567	1,157	0.53
REG. @ 10yrs and 5%	35,632,648	6	10,798	1,080	0.49
REG. @ 10yrs and 10%	30,000,172	6	9,091	909	0.42

the income and therefore consumption levels required to attain living standards comparable to the international poverty line ($1.9). The BCR also increased significantly from 5.7 to 9.8 respectively. The same figures for 10 years and 20 years range between 8.3 and 9.2 respectively under the different discount rates.

Regarding possible policy implications, the CBA shows that there is an acute need for effective intervention measures that can slow the ongoing land degradation in Baligubadle and improve upon the benefits generated by the combined effects of the restoration work and the communityled management model. These measures require a concerted effort by government, international programmes working in this area and local communities, to ensure a long-term and tailored sitespecific approach to tackle land degradation and preserve the ecosystem services underpinning local livelihoods and the economy. Specifically, an effective legal framework is needed, to support land tenure legislation, alongside greater administrative, technical and financial capability to enforce legislation to slow the land degradation through enhanced customary law-based land use managed systems that historically governed communal pastures like the Bookh site. Alongside this, well-planned transitioning of livelihoods from current mainly pastoral strategies toward more agropastoral options, with greater diversification of incomes and therefore reduction of current land pressures from overgrazing in highly populated areas like Baligubadle, are necessary. In this regard, a long-term strategic approach to sustainable management of rangeland ecosystems services can potentially be used as part of an overall national recovery and resilience-building strategy to stabilize and improve rural living standards, and therefore serve as appropriate policy levers to alleviate the widespread poverty in the region.

TABLE 3

Benefits of scenarios across different discount rates and time horizons (Bookh)

Scenario	Aggregate NPV	BCR	Aggregate NPV per HH	Annual NPV per HH	NPV per person per day
BAU @ 47yrs and 3.5%	63,580,741.67	5.74	25,432.30	541.11	0.25
BAU @ 47yrs and 5%	58,265,417.71	5.88	23,306.17	495.88	0.23
BAU @ 47yrs and 10%	46,095,824.63	6.21	18,438.33	392.30	0.18
REG. @ 43yrs and 3.5%	101,972,677.52	9.77	40,789.07	867.85	0.40
REG. @ 43yrs and 5%	90,042,616.19	9.48	36,017.05	766.32	0.35
REG. @ 43yrs and 10%	65,488,672.42	8.84	26,195.47	557.35	0.25
REG. @ 20yrs and 3.5%	90,102,388.07	9.22	36,040.96	1,802.05	0.82
REG. @ 20yrs and 5%	82,135,210.54	9.09	32,854.08	1,642.70	0.75
REG. @ 20yrs and 10%	63,247,827.43	8.70	25,299.13	1,264.96	0.58
REG. @ 10yrs and 3.5%	68,203,914.48	8.54	27,281.57	2,728.16	1.25
REG. @ 10yrs and 5%	64,395,105.49	8.49	25,758.04	2,575.80	1.18
REG. @ 10yrs and 10%	54,170,404.12	8.31	21,668.16	2,166.82	0.99

08 Conclusions

The analysis suggest that the two mitigating interventions considered yield significant net benefits over a long time period and are able to reduce the progression of land degradation before gradual restoration, if maintained over time. However, neither option alone is able to lift households from poverty within the time horizons considered, with per capita benefits accruing to these households ranging between USD 0.16 and 0.59 for Baligubadle, and USD 0.25 and 1.25 for Bookh.

Given the very different ecological characteristics of the site, the timescales for the restoration of historic land cover will vary significantly. Bookh is covered by a mix of grass, shrubs and various woody acacia tree species which grow slowly, whilst the grassy pastureland can recover much quicker with reseeding and controlled grazing density. However, the benefits generated by improvements are greater in Baligubadle because of both dual agropastoral livelihoods and higher population density. This feature is obvious from the relatively incremental values of benefits from BAU; approximately 400% for Baligubadle over 43 years compared to 60% over 47 years for Bookh. It is therefore worth pointing out that Baligubadle yields benefit from multiple ecosystem services and therefore more diversified income sources – a feature that increases household recovery and resilience to shocks and hence reduces vulnerability.

With regard to sensitivity analysis, the discount rate and inflation effect weigh heavily on aggregate benefits. Although the BCRs for the intervention options over the longer time horizon (2063) are in general much higher than those for both BAU and other two shorter (10 years) to medium (20 years) term options, their aggregate benefits are lower in relative terms because of lower effects of the discount rate and inflation adjustment.

09 Recommendations

The key recommendations emerging from our analyses are:

Baligubadle

- Despite the declining communal rangelands, Baligubadle communities have largely maintained pastoral livelihood strategies and most households have not diversified their income sources toward agriculture. This possibly due to limited farming skills, and limited availability and high costs of inputs such as tractors and seeds. In this context, the registration of enclosures can be used as a policy lever to not only reduce current land pressures but also to promote economic diversification and strengthen household resilience to shocks.
- Effective transitioning of the current pastoral and village dwelling households (73%) largely depending on grazing, albeit in varying degrees, toward more agropastoral livelihoods, requires an appropriate legal framework and partnership with local communities to both enact and enforce land tenure legislation and strengthen the customary law.
- Registration of enclosures with strict designation of land use under the existing classification of land in pastoral, agricultural and forestry uses would be appropriate to mitigate current land degradation resulting from overgrazing and tree cutting. The site has a high livestock density (80 heads/km2) because of limited remaining communal land, and there are substantial numbers of agropastoralist households (21% of residents), most of whom stay in their land enclosures throughout the year. It thus makes sense to adopt a strategy that transitions the community toward more agropastoral livelihoods.
- Commercial incentives for agriculture can be enhanced further through training and support - necessary to promote agricultural land use, including commercial fodder production, which could reduce the impact of droughts in the region. Land registration will likely nudge landowners in areas designated as agricultural use to use land more for crop production alongside the grazing of their existing herds, whilst those in areas designated as pastoral land will likely open their enclosures more to rented grazing. The former group would also likely rent their land for agricultural use to generate additional income to meet the associated tax obligation and cost of inputs, resulting in the long run in a more diversified economy. Diversified livelihoods can create a context in which there is less reliance on unsustainable land use practices such as charcoal production and greater environmental stewardship.

Bookh

- In Bookh, a more formalized community governance model with inbuilt penalties for breaches of the current land use management option and rewards for good behaviour needs to be put in place to ensure that the benefits yielded are sustained. As part of land tenure legislation, government needs to create a legal framework for a land stewardship scheme which can be used to support development of community-led land use governance models, and more generally strengthen customary law.
- Greater oversight of the local environmental agency in community governance and monitoring and evaluation of its impact over time is necessary. In this regard, more capacity building in both administrative matters and ecosystem services assessment is necessary

to empower local institutions. With these skills they can better safeguard pastoral and agropastoral livelihoods across the country and promote economic growth.

- In order to support development of effective environmental policymaking, further capacity building of research institutions is necessary. The analysis presented in this study is largely based on FGDs with a limited number of key informants and use of limited available secondary data. This is considered acceptable given the training exercise in which this study is a core component. Nevertheless, more in-depth research based on population sampling, household surveys and GIS data is necessary to determine more precisely the extent of land degradation and its effect on local livelihoods. With larger samples, a more robust CBA, ideally underpinned by ecological modelling and taking a more complete account of the environmental changes, could be conducted.

References

Bolognesi M., Leonardi U. (2018). Analysis of very high-resolution satellite images to generate information on the charcoal production and its dynamics in South Somalia from 2011 to 2017. Technical Project Report. FAO-SWALIM, Nairobi, Kenya.

Dallimer, M., Stringer, L. C., Orchard, S. E., Osano, P., Njoroge, G., Wen, C, Gicheru, P. (2018). Who uses sustainable land management practices and what are the costs and benefits? Insights from Kenya, Land Degradation and Development, Volume29, Issue 9, September, Pages 2822-2835.

ELD Initiative (2015). ELD Initiative User Guide: A 6+1 step approach to assess the economics of land management. GIZ: Bonn, Germany.

Eswaran H, Lal R, Reich P. F. (2001). Land degradation: An overview. In Response to Land Degradation, Bridges EM, Penning de Vries F W T, Oldeman L R, Sombatpanit S, Scherr S J, (Eds.). Science Publishers, Inc.: Enfield, N H; 20–35.

FAO (2018), News Article, In Somalia, massive livestock losses have severely impacted livelihoods and food security, 21 March, Rome, accessed on 7thNov. 2019.

FAO and World Bank (2018), Rebuilding Resilient and Sustainable Agriculture in Somalia.

Federal Government of Somalia (2018), Somalia Drought Impact and Needs Assessment, Volume I, synthesis report.

Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.) (2012), Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation.

Gure, A. (2017), Journal of Climatology & Weather Forecasting, 5:2.

Hoffman, M.T., and Ashwell A. (2001). Nature Divided: Land degradation in South Africa. 1-168. University of Cape Town Press, Cape Town.

Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change (IPCC) Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.

GIZ, Sustainable land management in «Somaliland», Somalia, 2015-2019 *https://www.giz.de/en/worldwide/37266.html.*

IPBES (2018): The IPBES assessment report on land degradation and restoration. Montanarella, L., Scholes, R., and Brainich, A. (eds.). Secretariat of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Bonn, Germany. 744 pages. Mirzabaev, A., J. Wu, J. Evans, F. García-Oliva, I.A.G. Hussein, M.H. Iqbal, J. Kimutai, T. Knowles, F. Meza, D. Nedjraoui, F. Tena, M. Türkeş, R.J. Vázquez, M. Weltz, 2019: Desertification. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D.C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. In press.

Musa, A.M., Wasonga, O.V. & Mtimet, N. (2020). Factors influencing livestock export in Somaliland's terminal markets. Pastoralism 10, 1. *https://doi.org/10.1186/s13570-019-0155-7.*

Nyumba, O. T., Wilson, K., Derrick, C. J. and Mukherjee, N. (2018), The use of focus group discussion methodology: Insights from two decades of application in conservation, Methods Ecology and Evolution. ;9:20–32.

Olsson, L., H. Barbosa, S. Bhadwal, A. Cowie, K. Delusca, D. Flores-Renteria, K. Hermans, E. Jobbagy, W. Kurz, D. Li, D.J. Sonwa, L. Stringer (2019): Land Degradation. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. In press.

Onwuegbuzie, A. J., Dickinson, W. B., Leech, N. L. and Zoran, A. G. (2009), International Journal of Qualitative Methods, 8(3).

Onwuegbuzie, A. J., Leech, N. L., & Collins, K. M. T. (2008). Interviewing the interpretive researcher: A method for addressing the crises of representation, legitimation, and praxis. International Journal of Qualitative Methods, 7, 1-17.

Pricope, N. G., Husak, G, Lopez-Carr, D., Funk, C., Michaelsen, J. (2013), Global Environmental Change Volume 23, Issue 6, December, Pages 1525-1541.

Sala, O.E., Yahdjian L., Havstad K., Aguiar, M.R. (2017) Rangeland Ecosystem Services: Nature's Supply and Humans' Demand. In: Briske D. (eds) Rangeland Systems. Springer Series on Environmental Management. Springer, Cham.

Somaliland National Development Plan II, 2017-2021.

UNCCD, 1994: United Nations Convention to Combat Desertification. United Nations General Assembly, New York City, 54 p.

Vargas, R. R., Omuto, C.T., Alim, M.S., Ismail, A., Njeru, L. (2009). FAO-SWALIM Technical Report L-10: Land degradation assessment and recommendation for a monitoring framework in Somaliland. Nairobi, Kenya.

Venema, J.H., Alim, M., Vargas, R.R., Oduori, S and Ismail, A. (2009). Land use planning guidelines for Somaliland. Technical Project Report L-13. FAO-SWALIM, Nairobi, Kenya.

World Bank Group (2019). Somali Poverty and Vulnerability Assessment: Findings from Wave 2 of the Somali High Frequency Survey. World Bank, Washington, DC. World Bank.

Annex 1: Data

TABLE 4

Data for Baligubadle site

General information	
No. of residents	3,300.0
Total site area (ha)	840.0
Labour wage, charcoal (per day, in USD)	3.0
Labour wage, animal rearing (per day, in USD)	0.5
Labour wage, farming (per day, in USD)	2.3
Seed quantity, maize (Kg/ha)	8.0
Seed quantity, sorghum (Kg/ha)	6.0
Seed quantity, tomato (Kg/ha)	0.5
Seed quantity, green pepper (Kg/ha)	0.5
Seed quantity, chilli (Kg/ha)	0.5
Average livestock off rate, camel (%)	0.016
Average livestock off rate, shoats (%)	0.15
Average camel price ($/head)	350.0
Average shoats price ($/head)	50.0
Average household meat consumption (Kg/week)	0.5
Average household milk consumption (Litre/week)	20.0
Meat price ($/Kg)	5.0
Milk price ($/litre)	0.5
Charcoal production	
No. of days for charcoal production (per site)	3.0
No. of people per site	6.0
Volume of production per site (18 kg bags per month)	100.0
Number of metal sheets per site (2.5 m*1m)	3.0
Price for charcoal (per 18kg bag in USD)	15.0
Repeated use of metal sheets (no. of sites)	10.0
Cost per 3 metal sheets (USD)	20.0
Labour wage, charcoal (per day, in USD)	3.0
Total no. of lorry loads per month	10.0
Average load per lorry (no. of bags of 18kg)	160.0
Cost per load (160 bags of 18 kg each)	200.0
Fine per bag	0.3
Total no. of sacks	1,600.0
No. of sites	16.5
Agricultural production (two seasons, rainfed)	
Number of agropastoral households	700.0
Average cultivated land (ha)	0.3
Maize production (tonne/ha)	0.5
Sorghum production (tonne/ha)	0.5
Tomato production (tonne/ha)	1.0
Green pepper production (tonne/ha)	0.5
Chilli production (tonne/hectare)	1.0
Maize/sorghum straw production (tonne)	2.0
Tractor cost ($ per ha)	35.0
Price for maize ($ per kg)	1.1
Price for sorghum ($ per kg)	0.9
Price for tomatoes ($ per kg)	1.5

TABLE 4 (CONTINUED)

Data for Baligubadle site

Price for green peppers ($ per kg)	2.4
Price for chilli ($ per kg)	0.9
Maize/sorghum straw ($ per tonne)	45.0
Seed, maize ($/kg)	1.1
Seed, sorghum ($/kg)	0.9
Seed, tomato ($/kg)	15.0
Seed, green pepper ($/kg)	11.8
Seed, chilli ($/kg)	11.8
Grazing production	
No.of pastoral households	900.0
No.of agropastoral households	700.0
Village residents	1,700.0
Average size of head pastoral households (camels)	20.0
Average size of head pastoral households (shoats)	50.0
Average size of head agropastoral households (camels)	5.0
Average size of head agropastoral households (shoats)	20.0
Average size of head agropastoral households (cattle)	3.0
Hay (xadhig=20 kg USD)	12.0
Hay (USD 1kg)	0.6
No. of animal grazing per ha (20 days)	20.0
Carrying capacity of site (840 ha), 20 days	16,800.0
Carrying capacity of site (840 ha), 30 days	25,200.0
Consumption per head of animal per day (kg)	3.0

Firewood	
Average size of firewood collection per household (xidhmo, 20 Kg)	20.0
Average firewood usage per household per day	6.7
Price of firewood per kg (equivalent to 6kg of charcoal, USD)	1.5
Building material (poles etc)	
Number of poles per household, per year	30.0
Average value ($)	0.5

TABLE 5

Data for Bookh site

General information	
No. of residents	2,500.0
Total site area (ha)	1,730.0
Average livestock off rate, camel (%)	0.016
Average livestock off rate, shoats (%)	0.15
Average camel price ($/head)	350.0
Average shoats price ($/head)	50.0
Average household meat consumption (Kg/week)	0.5
Average household milk consumption (Litre/week)	80.0
Meat price ($/Kg)	5.0
Milk price ($/litre)	0.5
Weeks of the year	52.0
Grazing production	
No.of pastoral households	1,300.0
No.of agropastoral households	800.0
Village residents	400.0
Average size of head pastoral households (camels)	40.0
Average size of head pastoral households (shoats)	100.0
Average size of head pastoral households (cattle)	20.0
Average size of head agropastoral households (camels)	15.0
Average size of head agropastoral households (shoats)	50.0
Average size of head agropastoral households (cattle)	10.0
Labour wage, animal rearing (per day, in USD)	1.5
No. of animal grazing per ha (20 days)	10.0
Carrying capacity of site (1730 ha), 20 days	17,300.0
Carrying capacity of site (1730 ha), 30 days	51,900.0
Consumption per head of animal per day (kg)	3.0

Annex 2: Questionnaire for FGDs

TABLE 6

Focus groups	Assumptions	Data to collect from secondary data sources
Introduction: My name is…….I am working with a research case study looking into the land degradation that happened in your area over the past years. I would like to know about how and when these changes have occurred, and understand reasons as why they happened, and what actions have been taken by government, NGOs and local community, if any. I will also ask you a number of specific questions related to value attached to benefits drawn from local rangelands including grazing, firewood, charcoal etc.		
Tell me about changes that have occurred in rangelands in your area?		
What are the most visible changes you have observed in recent years?		
In your opinion, what the key reason as to why these changes occurred?		
How these changes have affected your livelihoods?		
In the last 12 months, were trees cut for charcoal production?		
If the answer is ‚yes' then ask the following:		
What types of trees were cut to produce charcoal?		Find out the number of trees going into one bag to come from the literature depending on the species used
How many households use communal area/private enclosures/sustainable grazing area for charcoal production?		
Thinking about a typical household engaged in charcoal production, answer the following questions:		
Costs		
How many days were spent producing charcoal including cutting, burning, bagging, transporting?		In the focus group, ask once what the local labour payment rates are per person day
How many hours per day were spent doing this?		
How much it costs to transport a bag of charcoal to market?		
Are there any other significant costs in charcoal production and marketing?		
Benefits		
How many bags of charcoal were sold past 12 months?	1 bag = approx. 50kg. Use this assumption to work out how much 1 kg of charcoal sells for	
In total, How many Somalian Shillings were gained per bag?		
Fixed costs		
How many iron sheets are needed?		How much does the equipment cost?
How long do they last?		How long does it last?
How much does 1 iron sheet cost?		How much did an empty bag for putting charcoal in cost?
What equipment is used for cutting trees? (e.g. an axe)		

TABLE 6 (CONTINUED)

Primary data to ask for in focus groups		
Tell the focus group that for firewood you are asking about the last 12 months, and for firewood collection within the communal grazing area/private enclosures/sustainable grazing area as appropriate for the community you are in		
Was firewood collected from the communal grazing area/private enclosures/sustainable grazing area?		
If the answer is yes, ask the following questions:		
How many households used the communal area/private enclosures/sustainable grazing area for firewood collection?		
Thinking about a typical household engaged in firewood collection:		
How many days were spent collecting firewood?		Ask what the local labour payment rates are per person per day
How many hours per day were spent doing this?		
How many bundles were collected?	Assume that we value firewood collected for household use via market prices	Find out the number of trees going into one bag to come from the literature depending on the species used

Grazing material (grass)production	Assumptions	Secondary data
How many ha of land are within enclosures in the study area? (through GIS)		
How many ha of land are communally managed in the study area? (through GIS)		
How many ha of land are within the sustainably managed area (through GIS)		
Find secondary data sources to give information on the amount of grazing material produced by 1ha of enclosed land and communal land by season		
Use secondary data sources to see how much the grazing material is worth (market prices) per season		
How much does it cost per ha to rent enclosed land for the winter season?		
How much does it cost to buy a ‚load' of grazing material during the winter season	Ask what a ‚load or grazing density' is (e.g. camel, donkey cart etc) and the typical weight of grazing material in a ‚load'. This means you can work out how much it costs per kg	

TABLE 6 (CONTINUED)

Primary data to ask for in focus groups	Assumptions	Data to collect from secondary data sources
Tell the focus group that for wild fruit collection you are asking about the last 12 months, and for wild fruit collection within the communal grazing area/private enclosures/sustainable grazing area as appropriate for the community you are in		
Were wild fruits collected from the communal grazing area/private enclosures/sustainable grazing area?		
If the answer is yes, ask the following questions:		
How many households used the communal area/private enclosures/sustainable grazing area for wild fruit collection?		
Thinking about a typical household engaged in wild fruit collection:		
What were the three most commonly collected types of fruits?	Only ask about the most commonly collected fruits. Only ask for up to three fruits	
For up to 3 most commonly collected fruits:		
How many kg of fruit were collected in the last rainy season?	Value all fruit collected at the market prices received for any fruit sold	
How many kg were sold?		
How much were they sold for?		Check market prices from secondary data sources to confirm
How many hours were spent collecting and selling wild fruit?		Ask what the local labour payment rates are per person day

Primary data to ask for in focus groups	Assumptions	Data to collect from secondary data sources
Tell the focus group that for honey collection you are asking about the last 12 months, and for honey collection within the communal grazing area/private enclosures/sustainable grazing area as appropriate for the community you are in		
The questions cover wild honey collection only NOT beehives and bee keeping activities		
Was honey collected from the communal grazing area/private enclosures/sustainable grazing area?		
If the answer is yes, ask the following questions:		
How many households used the communal area/private enclosures/sustainable grazing area for honey collection?		
Thinking about a typical household engaged in honey collection:		
Did you collect wild honey in the last year?		
How many kg of wild honey were collected in the last year?		
How many kg were sold?	Value all honey collected at the market prices received for any honey sold	
How much did were they paid?		Check market prices from secondary data sources to confirm
How many days were spent collecting, processing and selling wild honey?		Ask what the local labour payment rates are per person day

TABLE 6 (CONTINUED)

To ask a traditional doctor only:
Ask the traditional doctor to think only about the medicinal plants they collected from the communal grazing/private enclosures/sustainably managed grazing area in your study area
Did you collect medicinal plants in the last 12 months from the communal grazing/private enclosures/sustainably managed grazing area?
If yes, ask the following:
How many days did you spend collecting and processing medicinal plants in the last year?
How much money did you make from the sale of medicinal plants in the last year?
What percentage of all the medicinal plants you sold did you collect from the communal grazing/private enclosures/sustainable managed grazing area?

Ask each individual to answer the questions below separately without conferring with others in the room:

Please indicate how much you agree or disagree with the following statements

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I feel happy when I am in the communal grazing areas					
I look forward to coming to the communal grazing areas					
Lots of things in the communal grazing areas remind me of past experiences					
I am proud of the communal grazing areas					
The communal grazing areas almost feel like part of me					
Compared to other communal grazing areas, this area has many advantages					
When I am in the communal grazing areas, I feel part of something that is greater than myself					
I really miss the communal grazing areas when I am away from it for a long time					
I have had a lot of memorable experiences in the communal grazing areas					
When I am in the communal grazing areas I feel strongly that I belong there					
I like the communal grazing areas					

replace ‚communal grazing areas' with ‚private enclosure' or ‚sustainably managed grazing area' (or appropriate local name for these patches of land) according to which focus groups you are carrying out

TABLE 6 (CONTINUED)

Focus Group Discussion

Establishing fencing and maintenance for private enclosures
How large (in ha) is your enclosed land?
Do you have fencing around your grazing land?
If yes, what is the purpose of the fence?
How many days did it take to build the fence (including cutting trees and moving them to the fence area)?
Each year, how many days do you spend maintaining the fence?
(check labour prices for agricultural labour)
Any income from owning a private enclosure: rental, grass sales
In the last dry season, did you rent out your enclosed land for grazing?
What did you get paid for renting out your land for grazing?
In the last year, did you cut and sell grass?
How many kg of grass did you cut and sell?
(ask what units they use for selling grass, and how many kg make up this unit)
How many days did you spend cutting, transporting and processing grass for sale?
(check labour prices for agricultural labour)
Communal lands annual management costs
No maintenance or establishment costs
Removal of fencing
Use secondary data sources based on previous experience to quantify the cost of removing fencing
Communal lands management costs (same as BAU)
No maintenance or establishment costs
Establishment and maintenance costs
Take known costs from the sustainably managed grazing area (Bookh)
Only include costs directly related to grazing management. Exclude animal welfare costs, livelihood intervention costs, land rehabilitation, resettlement costs

Co-funded by the European Union

german cooperation
DEUTSCHE ZUSAMMENARBEIT

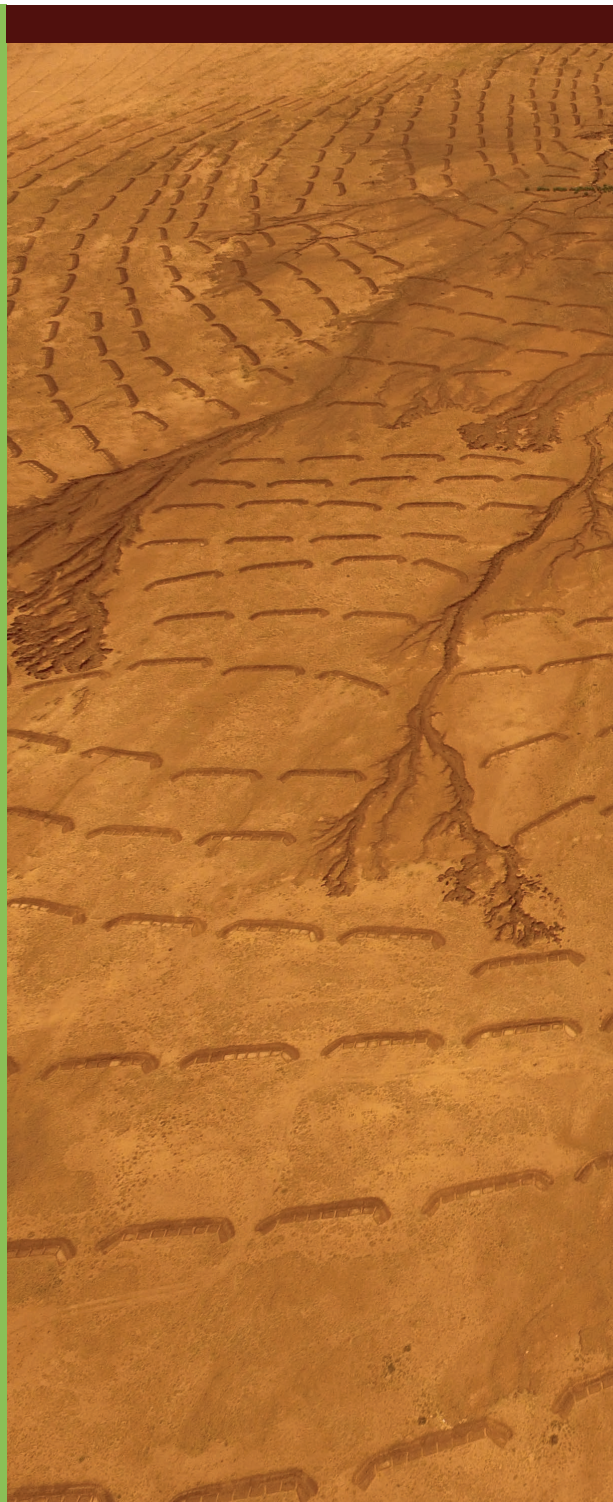
Implemented by giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Regreening Africa

AGRIBUSINESS SOLUTIONS HUB

UNIVERSITY of York

UNIVERSITY OF LEEDS



For further information and feedback please contact:
ELD Secretariat
Mark Schauer
c/o Deutsche Gesellschaft
für Internationale Zusammenarbeit (GIZ) GmbH
Godesberger Allee 119
53175 Bonn
Germany
T + 49 228 24934-400
F + 49 228 24934-215
E eld@giz.de
I www.eld-initiative.org

This brochure was published with the support of the Partner Organisations of the ELD initiative and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ)

Photography: Cover © Pascal Eisenschmid – Fotolia.com
Design: MediaCompany – Agentur für Kommunikation GmbH, Bonn Office
Printed in the EU on FSC-certified paper
Bonn, December 2013

www.eld-initiative.org