



# Landscape restoration in Ethiopia's drylands

Inception review  
The national context, with a focus on Tigray



Pastoral & Environmental Network  
in the Horn of Africa







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July 2020

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Cover photo: The landscape in Naeder Adet District, showing terraces that support land restoration. Photo: Dawit Gebregziabher



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# Executive summary

The success of dryland restoration efforts in Tigray has been extensively documented. The achievements are notable and significant, not only because of the scale and breadth of the impacts, but also because of the methods and processes employed. Here, we describe the successes, and the broader benefits of restoration, but we also look at some of the challenges and weaknesses that have been identified, and suggest improvements. Land restoration in Tigray has been supported by strong governmental programs, across successive administrations, and has benefited from close collaboration between international donors and NGOs, working with local research institutions. But, most importantly, it has been driven by communities, who have understood the threats posed to their livelihoods and had strong incentives to make the necessary short-term sacrifices, in terms of foregone incomes, in order to establish and police area exclosures.

This is based on a review of literature, supplemented by focus group discussions with community members, and key informant and expert interviews conducted in a COVID-safe manner in June-July 2020, when Ethiopia was in partial lockdown in an attempt to control the spread of the disease. Short-term and potential long-term impacts of the pandemic on local development and implications for land restoration efforts are considered.

Over many decades, Tigray has suffered from harsh droughts and a strong trend towards desertification. Famine in the 1980s received global attention and had traumatic and lasting local impacts, which continue to motivate local efforts to restore the environmental basis of local livelihoods. Low levels of agricultural productivity in communities that depend overwhelmingly on the land for their livelihoods, meant that with a rapidly growing population, young people increasingly migrated out to urban areas, to distant regions and abroad. But, mass mobilisation in a concerted effort to introduce land restoration and soil and water conservation efforts has enabled Tigray to achieve a dramatic success.

Over the past decade, tree cover and vegetation have been restored, and groundwater levels have increased so much so that water availability is adequate even in drought years. Pressures driving outmigration have diminished, and new livelihood opportunities have even led to an increase in the population in some communities. But, there have been challenges and setbacks. Currently, Ethiopia is struggling to cope with the impact of COVID-19 while in the midst of a major political shake-up, the fourth in its modern history. Civil unrest and political uncertainty are undermining project implementation and the prospects for development.

More fundamentally in terms of Tigray's land restoration efforts, there have been specific challenges, and some significant gaps must be addressed. The main measures adopted have been soil and water conservation on hillsides and across watershed, with large areas of communal land set aside for area exclosures, closed off to farming and grazing. These involve substantial community contributions in terms of unpaid labour and foregone incomes. Local people understand that these sacrifices will ultimately pay off at community level and maintained and improved household livelihoods and incomes – but they are starting to feel the strain. In the surveys, people said that they have not been adequately consulted in programs design, and would like to see greater emphasis on the selection of more productive and marketable plants, shrubs and trees.

They would also welcome a greater focus on support for family farms under COVID-restricted programs, which are based on extension with individual households as well as 'digital extension'.

This suggests a general desire for a policy switch towards boosting farm incomes, which is compatible with a switch towards area exclosures in which a particular mix of more commercially viable tree and plant species is actively promoted. This commercially directed approach to regeneration and land restoration would have to involve a collaborative process with farmers, herders, extension agents and local researchers, supported by international expertise. A new agenda for action must include more participatory and collaborative planning and design of area exclosures, a cohesive approach at landscape level involving multiple actors, and an effort to achieve commercial sustainability that is informed by both expert and traditional knowledge.

# 1. Landscape restoration in Ethiopia and the CRGE Strategy



## **Ethiopia – climate change and drivers of deforestation**

The major drivers of deforestation and forest degradation are agricultural expansion and fuel-wood extraction. Some 80% of Ethiopia's rapidly growing population of around 100 million is rural and depends on mixed, smallholder farming. The majority of Ethiopia's smallholder farmers live in the central and northern highlands, where land degradation is severe. Farm sizes are shrinking, and the average farm covers less than 0.5 hectares. Moreover, the nation as a whole has been severely affected by climate change and climate variability, and was still recovering from the exceptionally severe, region-wide drought of 2017-18 when the Covid-19 crisis hit.

Ethiopia has been affected by severe and frequent droughts since the 1970s. From the 1980s, the Government of Ethiopia (GoE) has undertaken major landscape restoration efforts, as part of a broader effort to protect the natural resource base that underpins livelihoods. National policy has long recognized that the livelihoods of the bulk of Ethiopia's population depend on the land, and its productivity. Environmental management and climate change mitigation have, accordingly, taken up a central place in policy making.

## **The evolution of the National Policy Framework from the 1990s**

- 1995 – Federal and Regional Constitutions – recognized land use rights of communities.
- Late 1990s to mid-2000s –The Sustainable Agriculture and Environmental Rehabilitation (SAER) initiative and national tree planting campaigns began and mass community and resource mobilisation undertaken.



- 2007 — The first National Forest Policy was issued and the Forest Law revised
- 2011 - Ethiopia formulated its CRGE Strategy, in which forestry was emphasized
- 2013 – GoE established a separate Ministry of Environment and Forestry (MEF)
- 2014 –Ethiopia pledged to rehabilitate 15 million hectares of degraded lands and 7 million hectares of forest by 2025 as part of the Bonn Challenge
- 2015 – The 2007 forest law was revised, enacted in 2016 with amendments that strengthened the rights of local communities and their ability to generate incomes from forest products.
- Emphasis on forestry research grew, with the establishment of Ethiopian Environment and Forestry Research Institute (EEFRI) both at Federal and Regional levels.
- The Ministry was given an expanded mandate and renamed as the Ministry of Environment Forestry and Climate Change (MEFCC).
- The 2011-2015 and the 2016-2020 Five Year Development Plans focused on the development of the forestry sector as one of the four pillars for building a Green Economy
- In 2018, the MEFCC became the Commission for Environment Forestry and Climate Change (CEFCC).

The major state-led forest landscape restoration initiatives have been area exclosures, aiming to rehabilitate 15 million hectares of communally owned, degraded land and hillsides. Alongside these efforts, complementary programs aim to rehabilitate critical watersheds, mobilizing the 'free' labour of communities. These voluntary community contributions obviously entail significant opportunity costs, but they also demonstrate a high degree of public "buy-in". Governmental efforts are supported by tree planting initiatives independently undertaken by smallholder farmers themselves.

### **Trees and forests in Ethiopia's CRGE strategy**

Ethiopia has developed natural resource management, conservation and utilization policy frameworks, supported by a series of national action plans and programs. Efforts to date include afforestation and reforestation initiatives supported by high levels of public mobilization. These aim to achieve sustained social, environmental and economic benefits that ultimately contribute to the overall objectives of rapid economic growth and poverty reduction. The rehabilitation of degraded lands and degraded forests is a priority in Ethiopia's natural resource management strategy, which is seen as underpinning sustainable economic growth.

Ethiopia aims to achieve middle-income status by 2025, while developing a green economy. Following the conventional development path would, among other adverse effects, result in a sharp increase in GHG emissions and unsustainable use of natural resources. To avoid such negative effects, the government has developed a strategy to build a green economy, and the GoE is working to translate the strategy into action.

The Climate Resilient Green Economy (CRGE) strategy put out in 2011, lies at the core of the government's development policy. A set of related interventions are being implemented to address environmental challenges in ways that support economic development. The Sustainable Land Management (SLM) program (phase 1 and 2), in collaboration with the World Bank and other development partners, are integral components.

The protection of forests is also an important component of the CRGE. Ethiopia has also been a leading participant in REDD+ and which is an integral part of the CRGE. The REDD+ program has been focused on the relatively lush, wetter forests of southern Ethiopia, with approaches based on Participatory Forest Management (PFM) and Farmer Managed Natural Regeneration (FMNR), notably in the Humbo Forest. But the program will be progressively extended to encompass the drier northern and eastern regions.

There have been substantial efforts to protect the major forests of southern and western Ethiopia with participatory forest management initiatives, largely undertaken by NGOs, with government providing the legislative and regulatory framework. GoE has also prioritized the REDD+ initiative, becoming the first African country to complete a REDD+ readiness programme in 2017, when Ethiopia's Readiness Package was officially endorsed at the 10th Participants Assembly of the Forest Carbon Partnership Facility (FCPF), triggering significant investments in Climate Change mitigation. Ethiopia aims to be a "green economy front-runner", and this is manifested in the GoE's strategy for a Climate-Resilient Green Economy (CRGE), and a determination to advance in the REDD+ regime (Dinku, 2017). Ethiopia's REDD+ Readiness Preparation Proposal was prepared in 2011, the same year as the CRGE was launched.

It is important to note here that the CRGE is a central component of the Growth and Transformation Plan (GTP), and is fully integrated in Ethiopia's development planning process. This is not an add-on, or window-dressing. The political and programmatic commitment is firm, and consistent.

## **Dryland reforestation**

Trees and forests are vitally important to dryland ecosystems. Tropical and sub-tropical dry forests occur in relatively frost-free areas where mean annual temperature is above 17°C, with several months of severe or absolute drought, annual mean precipitation of 250 to 2,000 mm and where potential evapotranspiration is greater than precipitation for a significant part of the year. They encompass everything from semi-deciduous forests to scrubland vegetation (Vieira and Scariot, 2006). Although there is great variation across sites, dry forests may contain from 30 to 90 different tree species, with canopy heights of 10-40 m, and 17-40 m<sup>3</sup>/ha of basal area.

In planning restoration efforts and designing strategies, serious consideration must be given to how quickly recovery into structurally mature ecosystems can be obtained. In promoting natural restoration, it is important to consider aspects such as structure and richness, phenology, seed types and dispersal, as well as seed banks, seed predation, germination, seedling establishment, fire resistance, and re-sprouting ability.

Also, dryland forest restoration cannot simply use the same approaches developed for moister forests and must be tailored to the dry conditions of the ecosystem. Dormant seeds support natural regeneration, but efforts to shape reforestation must take into account a number of specific issues. Small seeds and seeds with low water content are less susceptible to desiccation, a major barrier to establishment in open areas. Collecting seeds at the end of the dry season and planting when the soil has sufficient moisture can increase seedling establishment and reduce exposure to seed predators. Rainfall variability and long dry periods are important sources of mortality in seeds and seedlings (Vieira and Scariot, 2006). This underlines the need, discussed below, for site-specific management plans that are developed in collaboration with local experts.

Over the past two decades, at least one million hectares of degraded land have been restored in northern Ethiopia. A wide range of techniques have been used, such as excluding land from use by humans and by livestock to allow natural regeneration of vegetation (area exclosures), terracing, water harvesting; the construction of small dams to store water for infiltration or for irrigation, tree planting, and pasture development.

The systematic treatment of slopes with terracing and water harvesting techniques has led to a reduction in erosion and runoff. An increase in the water infiltration and the storage of water on slopes has led to groundwater recharge in valleys. This enabled the digging of shallow wells, making small-scale irrigation around wells possible, and thereby strengthening and diversifying livelihoods.

During 2015-17, the area under dry season irrigation in Tigray increased from 40 to 40,000 hectares. Moreover, this massive effort has brought about increased vegetation cover and biodiversity, at the same time providing ecosystem services in terms of improved microclimates, increased availability of forage for bees, availability of medicinal plants, and increased carbon storage.

### **Area exclosures**

Area exclosures (or simply exclosures) are identified as an important tool in Ethiopia's aim to rehabilitate 15 million hectares of degraded land over ten years, under the CRGE. Allowing degraded land to lie fallow for periods of time to promote natural regeneration is a time-honoured practice (Kassa et al., 2017). Area exclosures have been defined as "a method for land rehabilitation by protecting an area from interference of animals and human encroachment for a limited period of time depending on site capacity and vegetation re-establishment" (Aerts et al., 2006; Seyoum et al., 2015).

The size of exclosures varies widely, from just a few hectares to several hundred hectares. To establish an exclosure, an area of land is designated and demarcated before being closed off to users. Soil and water conservation efforts may be undertaken, or tree planting, or efforts to assist and shape natural regeneration by removing undesired species and promoting preferred tree species. This has not tended to be a major feature of programs in Tigray, but the need to 'direct' natural regeneration is now widely recognised, as explained below.

Rehabilitation in a particular locality involves a number of actors and institutions, while scaling out efforts across a landscape involves a larger and more diverse set of actors. Area exclosures involve rehabilitating degraded lands within a given watershed and scaling this out to neighbouring areas (horizontally), as well as establishing the institutional arrangements required for scaling up (vertically) at regional and national levels, in order to deliver large positive ecological impacts (Seyoum et al., 2015).

GoE began establishing exclosures in the 1980s in northern Ethiopia and Tigray, together with soil and water conservation measures. Given the enormity of the crisis that hit Tigray in the 1980s caused by a combination of natural and human factors, the need to reverse degradation and make land more productive was acutely evident, and public willingness to undertake and contribute to environmental protection was correspondingly strong. It may well be the case that the severity of Tigray's 1980s crisis explains the strength of its response and its leading role in land restoration efforts. This might suggest, unfortunately, that people will only undertake environmental protection measures when they face very strong incentives to do so.

Area exclosures now cover over 1.2 million hectares in Tigray alone, and other regions are seeking to emulate Tigray's success. In recent years, area exclosures have been taken up by governmental institutions in other parts of Ethiopia and are now widely seen as a necessary complement to, or an integral part of, soil and water conservation efforts. Sustained land restoration combining area exclosures with soil and water conservation measures have brought about large-scale environmental transformations of areas characterized by low rainfall, steep slopes and fragile soils. Men, women and children have moved by hand at least 90 million tonnes of soil and rock to reshape their landscapes. As a result, northern Ethiopia is now greener than ever, and certainly greener than it has been at any point in the last 145 years (Nyssen et.al., 2009; FAO, 2013).

### **Assessing the impacts and benefits of land restoration**

It is not difficult to demonstrate the benefits of land restoration at farm or project scale, and many studies have done this (Anwar et al.,2020; Tigist et al, 2020; Yigremachew et al., 2015; Yigremachew et al., 2015; Deschamber et al., 2009; Nyssen et al., 2009; Wolde et al.,2009). Reports produced by local NGO REST (The Relief Society of Tigray) and Mekelle University on two or three watersheds have demonstrated the broader benefits in terms of reduced soil erosion (Descheemaeker et al.,2005; Jan et al., 2009), enhanced biodiversity (Kide et al., 2018; Haile, 2016; Berhane et al., 2015; Emiru and Kiros, 2014), sequestered carbon (Chukwuebuka et al., 2020; Mengistu et al., 2018; Emiru et al.,2006), improved soil fertility (Tigist et al., 2020; Damene et al., 2013), the increased availability of food (Balehegn et al.,2019), feed (Wolde et al.,2011) and water (Seyoum et al.,2015; Lanckriet et al.,2014; Wolde et al.,2012; Nyssen et al., 2009; Wolde et al.,2009).

It is more difficult to demonstrate the 'unpriced' economic benefits at landscape scale, taking into account farm and household losses incurred. Here, the benefits, including broader benefits and enhanced ecosystem services, are dispersed, while the losses are concentrated. The key challenge is that the local resource users who forego incomes now, under exclosures, may not see direct benefits for 7 years or more according to estimates (Reij and Garrity, 2016), and they do not directly capture the wider ecosystem benefits that accrue at landscape scale. Ethiopia's Productive Safety Net Program (PSNP), with very substantial donor support, has been important in providing direct assistance to poor smallholders in northern Ethiopia. Direct support through fiscal transfers or social safety net programs can help exclosure participants to 'get over the hump' and absorb the short-term (opportunity) costs of exclosures, on the assumption that they will benefit more directly from exclosures in the longer term. But, a question mark hangs over the financial and fiscal sustainability of these programmes and their inherent donor-dependency.



## 2. Landscape restoration in Tigray



### Cases from three watersheds

#### *Introduction*

Tigray is among the most severely degraded regions in Ethiopia (Emiru et al., 2006, Hagos et al., 1999, Mekuria et al., 2007). Land degradation takes the form of soil erosion, gully formation, loss of soil fertility and moisture stress (Hagos et al., 1999). Land degradation also results from continuous deforestation, primarily caused by agricultural expansion, overgrazing and unsustainable extraction of forest products.

Under the African Forest Landscape Restoration Initiative (AFR100), African countries through the African Union have promised to restore 100 million hectares of degraded landscape by 2030. As part of this, Ethiopia has committed to restore 15 million hectares. “Forest Landscape Restoration (FLR) is defined as a process that aims to regain ecological functionality and enhance human well-being in deforested or degraded landscapes. FLR is not an end in itself, but a means of regaining, improving, and maintaining vital ecological and social functions, in the long-term leading to more resilient and sustainable landscapes” (Besseau et al., 2018). Landscape restoration efforts aiming to restore degraded lands have been an important component of the policy agenda of the Ethiopian federal government and that of Tigray region in particular. The successful rehabilitation of degraded areas in Tigray can contribute towards broader, national efforts, providing a model that can be adapted to fit conditions in the different regions, as well as learning around policies and practice. In this review, area exclosures and agroforestry are considered for landscape restoration in the region.

## **Exclosures**

Land degradation is a major problem in Ethiopia, with more than 85% of the land degraded to some degree (Gebreselassie et al., 2016). Recent estimates based on satellite imagery show land degradation hot spots cover about 23% of total land area (Chirwa, 2014). Ethiopia recently pledged to rehabilitate 15 million hectares of degraded land by 2030, and the government set out a plan for achieving this target (Seyoum et al. 2015; Seyoum, 2016; Mitiku, 2016; MoEFCC, 2017). Under this plan, about 50% of land to be restored – over 7 million hectares – will be established as area exclosures (Seyoum, 2016), being community owned areas that exclude anthropogenic activities such as free grazing and tree felling (Aerts et al., 2006).

In Tigray, implementation and management of exclosures involve formal and informal actors and organisations, including several federal, regional and local institutions. At the local level, implementation and monitoring is conducted by Tabia Council members, Woreda development agents, local and international NGOs, under the community watershed team (CWT) plan. Community members, government agencies and NGOs jointly develop local bylaws for exclosure management. Communities protect exclosures through the development and enactment of social sanctions, social fencing and bylaws to be followed by the community and social courts operating in the community. Bylaws are agreements and rules established by users to structure the management of exclosures (Mitiku and Kindeya, 2001; Desta et al., 2005). These are essential to avoid 'free riders' and illegal users of natural resources inside exclosures, to motivate local communities to take part in exclosure management, to minimize overexploitation and degradation of communal resources, to define the beneficiaries of the exclosures, and to avoid conflicts.

Bylaws include established criteria for defined violations of the rules, the type and amount of fines to be paid for rule violation, membership conditions, roles and responsibilities of members, and benefits and benefit-sharing arrangements. So, the rules governing exclosures have been established on the basis of a participatory process, examining prescriptions in a detailed manner and ensuring broad buy-in. Most communities prefer implementation of social sanctions and social fencing by creating social pressure on 'free riders' through measures such as not attending funerals and weddings of rule-breakers. So, relatively modest social sanctions, which may well have teeth, are preferred over enforcement through fines imposed by formal courts.

Tigray has been widely known to have a serious problem of land degradation, while serious efforts to address the problem have been widely noted (Hagos et al., 1999). Rural communities and the regional government have exerted efforts to rehabilitate degraded lands through the establishment of exclosures. Exclosure is a land management measure that limits anthropogenic interventions to the minimum in order to rehabilitate and restore degraded land and it is commonly practiced in Tigray (Mekuria et al., 2007, Aerts et al., 2009). Exclosures as part of the sustainable agriculture and environmental rehabilitation policy was started three decades ago (Yayneshet et al., 2009, Mekuria and Aynekulu, 2013, Gebremedhin et al., 2003).

In Tigray, restoring degraded ecosystems through the establishment of exclosures is an established practice, where some 1.5 Mha of land are covered by exclosures (Balehegn et al., 2019). Exclosures range from 1 ha to 700 ha in size (Nedessa et al. 2005), usually established in steep, eroded and degraded areas that have been used for grazing in the past (Descheemaeker et al. 2009). Exclosure management and protection have proven to be effective when local communities play active roles under the overall authority of the local government (Descheemaeker et al. 2006). Studies in Tigray show that exclosures can reverse land degradation, reduce soil erosion, minimize siltation of micro dams, increase soil fertility, improve ecosystem services and livelihoods

(Chukwuebuka et al. 2020; Adem et al., 2020; Tigist, 2020; Mengistu et al., 2005; Mengistu et al. 2018; Girmay et al., 2009; Emiru et al., 2006; Descheemaeker et al. 2006).

There are two strategies – biological and assisted – for using exclosures in land rehabilitation in Tigray (Balehegn et al., 2019). The biological strategy simply protects an exclosure against livestock and human interference with no additional management required, promoting ecological succession from the recruitment of buried or dispersed seeds (Aerts et al., 2006). The assisted strategy, which is more common, involves planting seedlings raised in common nurseries and the construction of soil and water conservation structures such as bench terraces, stone bunds, infiltration galleries and micro-basins, to speed up succession by modifying microclimatic and soil conditions (Aerts et al., 2006). To restore the soil seed bank, harvesting grass for fodder is normally restricted to once a year using a cut and carry system, usually beginning 2-3 years after exclosure establishment, once grass has regenerated sufficiently. Honey production and the collection of medicinal plants are also allowed.

### **Agroforestry**

Agroforestry is one component of landscape restoration. Adding trees to agricultural land lead to benefits including enhanced soil fertility, reduced erosion, improved crop productivity, shade and fodder (Besseau et al., 2018). For example, *Faidherbia albida* is among the dominant tree species found in farmers' field and also communal land in Abreha We Atsbeha watershed, enhancing soil fertility, and providing fodder and shade for people and livestock.

## **Case studies on the best practices**

### ***Gergera watershed***

It covers 1,382 hectares in Hayelom Kebele in Atsbi-Wonberta district. Local community members provided 40 days of 'free' labour, alongside paid work supported by donors, with the involvement of Irish AID widely acknowledged to have been vital in the rehabilitation the watershed. The World Agroforestry Centre (ICRAF) also supported land restoration through the establishment of a rural resource centre, which was established to support evidence-based landscape restoration, working in collaboration with the government and local communities. The government's Productive Safety Net Programme (PSNP) also contributes through cash transfers or in-kind support for those contributing labour. Here we should note that different rehabilitation efforts, led by communities, NGOs and government, have been undertaken in Gergera watershed over the past two decades. Practices included the rehabilitation of hillsides through the natural regeneration of vegetation, with designated areas set aside for this, the treatment of gullies through gabions, and the planting of elephant grass along river banks. These efforts have contributed to an increase in groundwater recharge and this has benefited many farmers with increased production on irrigated farms. About 1,000 hectares of land along the valley is now under small-scale irrigation.

Landless youth in this area have a longstanding history of extra-legal migration. In pursuing this option, young people have faced serious challenges and threats, often risking their lives in complex schemes involving many actors. There are groups of young people in the area who returned after failed attempts to migrate. They have started to benefit from the nursery established for land restoration development in the watershed, and have been able to make money by producing tree seedlings and fodder grasses for farmers and land rehabilitation programs in the area. Moreover, one major goal of this hillside and landscape rehabilitation is to develop land for landless youth, with the government planning to provide hillsides plots (0.25 ha, 50x50 m).

So, land restoration activities have now become an emerging alternative for landless youth. It is hoped that land rehabilitation can improve the livelihoods of local community members, create job opportunities for landless youth, and help to reverse the ever-increasing out-migration from the area.

### ***Abreha We Atsbeha watershed***

This watershed lies in eastern Tigray, 71 km from the regional capital Mekelle, and was widely known across the region for the severity of local land degradation, characterised by soil erosion and water scarcity that are the principal challenges for agricultural production. In eastern Tigray, crop failures and dependence on food aid, along with a whole set of related problems, continue to present major challenges.

Facing a crisis, the local community was presented with two options - resettle into another area under a government resettlement scheme, or rehabilitate their degraded land so that it might become more productive and support their livelihoods. Local leaders and in particular one outstanding visionary, convinced community members that rehabilitation was a viable option. In any case, resettlement in distant areas with different cultures and languages was a very unattractive option. So, community members had very strong incentives to make rehabilitation work. A number of practices were implemented including stone bunds, trench bunds, a series of check dams and percolation pods. Community members understood that it would take years before rehabilitation generated any benefits in terms of increased production and incomes, on the basis of in-depth discussions with well-informed local leaders, and that they would have to make sacrifices over the short to medium term to secure their livelihoods in the long term. To achieve success, it was clear at the outset that rehabilitation efforts would need to bring about behavioural change, and households would have to fundamentally change their approaches and practices.

A former village head, Aba Hawi ('the father of fire') provided leadership, not just by speaking about the potential of new farm management options, but also by demonstrating them on his own farm. Local people were able to see how new approaches and technologies turned Aba Hawi's farm into a lush and productive site, and this was effective in promoting behavioural change and the uptake of new methods which drew on both traditional knowledge and international expertise. Widespread uptake produced tangible benefits over the short to medium term, with enhanced groundwater levels enabling enhanced production and strengthened local commitment to persist with rehabilitation efforts.

### ***Merere watershed***

Merere village is a remote dryland village in Kola Tembien, central Tigray. An interview with the village head provided good background. He stated that the area was barren 15 years ago, there was no irrigation in the village, limited drinking water supply so local people had to travel long distances to fetch water, and they were also dependent on food aid.

But, today the area looks very different. It has been transformed by the sustained participation of the local community in rehabilitation efforts. Community members contributed their labour to a collective conservation effort. Soil and water conservation was also implemented by the local community, with the support of government and donor-funded programs over a number of years. Villagers constructed hillside terraces and soil bunds, and implemented a range of measures. Basic irrigation systems were installed and micro-dams were constructed. The village leaders, Gebregziabher Gebrewahid and his neighbours constructed stone terraces and sink wells. The village has a 9 km long irrigation ditch along the contour of the hill.



These landscape restoration efforts have had substantial impacts. Local communities benefited in terms of increased availability of water for human consumption and irrigation. The area of irrigable land on hillsides increased significantly and fruit trees were planted along contours. The expansion of irrigation has increased the diversity of food production. There are also rehabilitated exclosures in the watershed. Local communities increased cut-and-carry fodder supplies from both exclosures and irrigated lands. In addition, rehabilitated land was allocated to landless youth, giving them new livelihood options and thereby helping to reduce out-migration. There have also been some positive impacts from a gender perspective. The workloads of women who are mainly responsible for fetching water have been greatly reduced by the availability of drinking water closer to households. This has reduced work burdens on women and freed up time for other activities.

*“The people of Merere made a miracle happen: this landscape, once barren and vast, was transformed to green, fertile land by the labour of the locals”* World Future Council

### ***Empirical studies on the impacts of land restoration practices***

A study in Abraha We Atsbaha concluded that landscape rehabilitation has the potential to restore degraded lands to productive uses, enhance ecosystem services mainly through an increase in groundwater levels, and improve agricultural productivity, boosting annual production by a factor of 2 to 3 (Biedemariam et al., 2017). This was made possible by the establishment of 650 hand dug wells used as sources of water for irrigation. Local community members are now producing fruit and vegetables, enhancing food availability for households, boosting incomes from marketed produce, and bolstering food security. The study also reported that agroforestry has improved community resilience through the provision of fuelwood, fodder, timber and non-timber products, and new sources of employment. Agroforestry also has the potential to reduce vulnerability to natural hazards, reduce soil erosion and enhance microclimates, as well as helping to reduce out-migration by providing new opportunities for young people (Gebru et al., 2019).

Exclosures were effective in rehabilitating degraded drylands, compared to adjacent open areas (Emiru et al., 2006), had positive effects in terms of the regeneration of grazing land when compared with open grazing sites (Yayneshet et al., 2009; Gebregerges et al., 2018), were effective in restoring native vegetation (Mekuria and Veldkamp, 2012) and degraded soils (Mekuria and Aynekulu, 2013), and performed better in terms of ecosystem services when compared to the adjacent grazing lands (Mekuria et al., 2007). Exclosures also increased species composition and diversity, biomass production and woody structure, as compared to adjacent grazed areas (Yayneshet, 2011), also seen from remote sensing analysis (Gebrehiwot and Veen, 2014).

Numerous studies have demonstrated the effectiveness of area exclosures in restoring degraded land and significantly enhancing ecosystem services. Positive outcomes at watershed level are not hard to demonstrate, but there is a question as to whether environmentally-destructive economic activities might have been displaced to other regions. For example, have these positive results come at the expense of increased charcoal production in the neighbouring Afar Region, supplying domestic fuel for households in rural and urban Tigray?

### ***International awards for land restoration in Tigray***

The Gold Future Policy Award 2017, under the auspices of the World Future Council and the United Nations Convention to Combat Desertification (UNCCD), was awarded to Tigray Region

for greening its drylands. This award recognised Tigray for having the best policies to combat desertification and land degradation, and the efforts made by communities to restore degraded lands. The Tigray regional government contributed to this achievement by mobilising community members to provide 20 days of free labour per year to construct terraces on hillsides, helping to scale up restoration efforts. These activities have contributed to reduced erosion, increased ground water recharge and the establishment of sustainable agricultural practices, which together, make households food self-sufficient, boost agricultural productivity, and help to diversify livelihoods, providing new opportunities for youth and reducing migratory pressures.

The success of the initiative in Abreha we Atsbeha delivered significant short to medium term benefits to the local community in terms of increased water availability and related incomes. Beyond this, activities provided a source of knowledge, and constitute an experience sharing centre for a wide range of audiences at woreda, regional, national and international levels. Accordingly, the watershed has received a number of awards in recognition of these successful landscape restoration efforts at regional and national levels. The community received the Equator Prize in 2012 from the United Nations Development Programme (UNDP) in recognition of efforts to provide “sustainable development solutions for people, nature and resilience communities”.

## **Effects of COVID-19 on land restoration**

Focus group discussions (FGDs) were conducted in a COVID-secure way, with appropriate social distancing, face covering (masks or bandanas), and hand washing. Key informant interviews (KIs) were undertaken face-to-face and remotely (by mobile phone). Questions were focused on restoration of degraded land in Tigray and effects of COVID-19. A checklist of questions and interview protocol was agreed in advance by the research team.

### ***FGDs with farmers and development agents from central and southern Tigray***

FGDs with a total of 21 farmers (11 men and 10 women):

- All respondents were very much aware of the land restoration measures that have been undertaken over a number of years, with detailed knowledge of activities and impacts.
- All had contributed their labour as community members.
- All of those consulted said that substantial benefits had been realized.
- 18 people confirmed that government officials informed them about the nature of the COVID-19 pandemic. They endeavour to abide by the preventive guidelines established, even though their knowledge and understanding of COVID-19 remains limited. They put their faith in God!
- 3 were aware of the pandemic but do not strictly follow precautions prescribed by health authorities.

FGDs with 20 development agents (8 women and 12 men):

- All acknowledged the efforts taken over a number of years to promote land restoration and rehabilitation practices in the communities in which they work, monitoring and evaluating development efforts.
- All were aware of the pandemic through local and national media, as well as government directives.
- Movements to the field are restricted and community mobilization is significantly reduced.
- Due to COVID-19, extension with families (households) is emphasised rather than community mobilization.
- Family members are engaged in digging pits for tree planting for reforestation.

- The prices of some commodities have increased. Supplemental income from field allowances is reduced.
- Sanitizers and masks are becoming expensive, and difficult for local people to afford.

#### COVID-19 impacts on agricultural production, supply chains and markets

- Due to the increase in transport costs, farmers are selling their produce in local markets, rather than serving larger urban and regional markets.
- Goods sold on local, village level markets fetch lower prices. If this situation continues farmers may not be motivated to produce vegetables, which may perish before reaching markets.

#### COVID-19 impacts on exclosures and state forests

- There is not, as yet, much difference between pre and post COVID-19 situations.
- There is free grazing (encroachment on exclosures) in some places, but this is not related to the pandemic.
- There are no loggers in either exclosures or the state forests.
- There are no unusual mining activities.
- One might speculate that continued lockdown restrictions, by placing further pressures on local livelihoods and incomes, will generate strong incentives to encroach on exclosures.

#### ***Kills with experts (research and extension workers, policy makers and development partners)***

- An Emergency Decree (operative from February to the end of April) initially curtailed several activities related to community mobilization, particularly for soil and water conservation, since the lockdown prohibited the movements of extension agents and development partners to project areas.
- From May 2020, restrictions on movements were lifted, but regulations still prohibited mass meetings and community mobilization.
- There has been a shift from mass mobilization to activities centred around households, using household labour and resources for reforestation. Family members are contracted to dig seedling planting pits using their own tools to avoid generating a large number of contacts in the context of the pandemic. Pits are dug 2 m apart, that allows physical distancing between people carrying out the work.
- Farmers are now engaged more intensively in producing vermicompost and manure to improve soil health.
- There is a greater focus now on improving in-situ rain water harvesting from smaller watersheds.
- Bylaws are in place but need more effective enforcement. The Bureau of Agriculture and Natural Resources is now enacting a new jurisdiction to strengthen existing bylaws to make them more effective and efficient.
- Exclosures in central, eastern and southern Tigray (Medebay Zana, Merere and Tisegea) have shown improved restoration, which reflects the fact that communities are maintaining and monitoring the performance of exclosures. However, there is still a problem of free grazing (encroachment).
- Community members are still encouraged to continue to use cut and carry methods to fatten small ruminants, and to collect honey from the beehives that were previously placed in the exclosures. In some areas, young people (both women and men) have been allocated land in the exclosures, to set up beehives as well as to cut and carry grass to stall feed livestock, as part of efforts to promote green job creation.

- There have been no reported cases of free riding (encroachment) in response to the pandemic.
- It has been possible to maintain communication with field staff, which enables them to work at household and family-farm level and to continue to support livelihoods through efforts to increase productivity.
- What is being felt critically as a major drawback resulting from the pandemic is the inability to conduct periodic evaluations, locally known as 'gemgam'.

### ***Salient points from discussions with local people and experts***

Communities at tabia and woreda levels have a good level of awareness about the COVID-19 threat, through information obtained from the Bureau of Health. The Emergency Decree issued by both the Federal and Regional governments has also strengthened awareness among communities on the potential impacts of COVID-19.

In response to the pandemic, community members now concentrate on managing their family farms and their own resources, utilizing family labour, principally, but also labour from student volunteers who have gone back to their tabias because of the closure of higher education institutions.

Farmers generally approve of the shift from the mass mobilization of communities for agricultural work, land restoration and development work to efforts centred on households and family farms, with an intensification of soil and water conservation activities. Farmers see this as a good opportunity to spend more productive time on their own farms, while also maintaining social distancing in the face of the pandemic.

Another consequence of the pandemic is in the minimizing of social gatherings such as baptisms, weddings and funerals, to which local people traditionally make financial contributions. Farmers say that this has been beneficial and claim that the suspension of such activities has boosted their savings and enabled them to make productive, livelihood-related investments. This short-term effect could even bring about a cultural shift that supports increased on-farm investment. But, this may come at the expense of a weakening of social bonds and social capital that underpin local livelihoods and also make it possible to mobilize people for land restoration and to maintain area exclosures. The transition from a social system based on social norms to one built around a legislative framework is a difficult one.

Policy perspectives are also flexibly addressing farming communities by introducing what is now being called 'digital extension'. This allows extension agents to use smart phones and tablets to collect data from villages and transmit it to higher bodies. This approach has greatly improved the accuracy of data as well as traceability for validation and verification. Messages and training materials are developed into videos, which are sent to Tabias that are provided with TV sets. Tabias that are connected to the national electric grid use the system, those with no connection are provided with solar panels that enable them to run the TV sets. Small groups of farmers (5-10) are addressed in larger halls to maintain social distancing, avoiding close contact between participants and limiting the number of contacts.

Community members understand that area exclosures and restored areas should be protected, with rigorous measures to prevent free riders from encroaching. In some communities, free riders are made to pay fines, and remunerate local communities for the ecological services that they have consumed.



But, we should note here that controls on firewood collection have been quite effective. The volume of firewood going to local markets has not increased, and in fact, in some places, it has decreased.

### 3. The ‘top 20’ challenges to scaling up success



These are significant achievements, and the impacts have been impressive, not only in terms of forest cover and regeneration, but also in terms of wider benefits through increased water security and community resilience. But there remain a number of challenges that must be addressed:

#### **1. A failure to manage and exploit trees effectively**

Vegetation in exclosures is for the most part protected, but it is not always sustainably managed or effectively exploited by local communities. Often, trees are not pruned, and so they grow as bushes rather than developing a trunk and a canopy. Because of this failure to manage trees effectively, local communities do not extract optimal environmental and economic benefits from exclosures. Suitably managed, they could produce much greater quantities of firewood or fodder. This suggests that training and awareness efforts have not been as effective as they could or should have been, and points to the need for greater efforts in this area.

#### **2. A failure to plan for the introduction and promotion of preferred, more productive tree species**

Species that regenerate naturally tend not to be those that align with preferences and priorities of local communities. This has been recognised for several years now, and in response, enrichment planting has been undertaken. However, these efforts have been undermined by a lack of experimentation and by ineffective management and coordination. What is required is a systematic review of related processes and the coordination of applied science to increasing exclo-

sure productivity, as well as meeting local community needs. Local research institutions can play important roles in facilitating participation and co-learning so that scientific inputs from national and international institutions are developed with local resource users and are therefore more likely to fit with local needs and priorities. It is important to recognise the crucial links between productivity-enhancing scientific input, community participation and the economic sustainability of exclosures, and between processes and outcomes.

### **3. The need to determine productivity and develop site-specific management plans**

Exclosures represent a significant share of dryland vegetation resources. In managing them, it is necessary to consider both conservation and utilisation objectives. Exclosures take up large areas of scarce land, and they must be productive if they are to be sustained. Resource users who forego incomes in the short-term must be confident that they will be adequately compensated in the medium to long term. Several studies have estimated the productivity of individual exclosures, but no comprehensive, site-specific management strategy has been developed, and site-specific assessments and plans are important for ensuring the sustainable management of exclosures. At the same time, studies to assess productivity at landscape level, taking account of leakages as well as downstream benefits that accrue to others beyond the exclosure will be important in estimating and quantifying overall impacts and productivity.

### **4. Uncertainties surrounding land tenure, rights and decision making**

Local communities are often unsure about their rights with respect to exclosures. Do they have the authority to make decisions about their protection and management, or is the government responsible for making such decisions? There is a degree of encroachment on exclosures by 'free riders', either in collusion with local leaders or on their own initiative, cutting trees or even cultivating plots of land. Are there mechanisms for monitoring such encroachment? And how can the maintenance of exclosures be balanced with the needs of landless youth?

Area exclosures have largely been undertaken on communal land. Uncertainty over ownership and use rights are particular problems in large forests in southern Ethiopia under participatory forest management. Use rights are clearer in Tigray, where there is a patchwork of smallholder farms and communal land with rules that are more clearly established and administered by traditional institutions and local authorities. Nevertheless, there is persistent uncertainty around land tenure and the ability of local institutions to manage land and exclude free riders from common resources. This uncertainty persists in spite of decades of policy attention. The recently amended Forest Law appears to be an important step forward, but looking around the region and the world, there are no good examples of neatly resolved land tenure policy and practice. There will always be contention and negotiation. What matters is establishing a reasonable degree of predictability and stability, strengthening the capacity of local resource users to negotiate, and to increase their confidence to invest in land restoration with some assurance that they will reap the benefits.

In general terms, land tenure insecurity diminishes the incentives to invest in land management and proper stewardship. But the social dimension is critical here. Traditional institutions and locally agreed rules governing land use can be effective, provided that there is wide acceptance of their validity, with appropriate social sanctions for the small number of rule-breakers.

In the case of Tigray, it is important to note that exclosures have been closed off to human activities on the basis of agreed and widely accepted community bylaws. But, are these by-laws respected by all? Local governance has not necessarily been inclusive of social groups, and there are emerging demands from women and youth for greater participation in governance. The gender dimensions of exclosures need to be carefully considered. Communities are composed of men, women and children and all play roles in the protection of exclosures. Their creation may have negatively affected women who are responsible for firewood collection, but their sustainable management and exploitation may positively affect women due to an increase in the availability of exploitable biomass. Whether this happens will also depend on the role women play in exclosures management committees. There is growing recognition that fostering women's involvement in local governance and decision-making can enable them to play a greater role in restoring and protecting ecosystems and forests (Elkington, 2019).

In their review of restoration and forest protection efforts, Kassa et al. (2017), also covering participatory forest management, a related approach that has been employed across southern and western Ethiopia, make this point and identify a number of additional challenges and limitations regarding exclosures, discussed below.

## **5. Inadequate community participation and a failure to include all local stakeholders**

With a few exceptions, insufficient efforts were made to convince and meaningfully engage all segments of local communities. The process of selecting participants should have been more transparent and inclusive, and while communities were consulted, this was largely done in a top-down manner. Not enough was done to take into account the diversity of local stakeholder views and differing objectives. Importantly, there was no systematic effort to seek the views of local people who had reservations about exclosures, address their concerns and encourage their participation in the planning process. Even active participants felt that their voices were not heard when it came to making key decisions on objective setting, management plans, and benefit sharing mechanisms. According to those consulted, decision making in these crucial areas was dominated by (senior) government officials, confirmed in a subsequent survey. For the most part, little effort has been made to engage with community members who are not directly involved in the establishment and management of exclosures. These schemes are thus often working with only a subset of community members, and failing to take into account the implications for non-participating members. This sets up an insider-outsider dynamic that can generate local conflicts and undermines project sustainability.

## **6. The lack of land use planning and a failure to define and demarcate forestlands**

The lack of a national land use plan and the lack of an official definition for forest and forestlands makes it harder to protect forests and promote restoration. In the absence of clear, appropriate definitions and land demarcation, areas that either should be forested or defined as forestlands are turned over to other uses, mainly farming. So, in this view, stronger governmental efforts in land use planning are necessary to prevent the on-going encroachment of agriculture into forested areas.

## **7. Persistently high poverty levels and landlessness, in the face of a 'youth bulge'**

High levels of poverty and landlessness, with some 80% of Ethiopians still living in rural areas, and continuous rapid population growth, intensify pressures on land and forests. Notwithstanding the growth of rural towns and some success in terms of economic diversification, large numbers of young people in rural areas are looking to develop rural, natural resource-based livelihoods. For many, the easiest option is to clear areas of forest to establish new farms. More frequent and severe drought has exacerbated these problems. Growing numbers of people, particularly the young, depend for their livelihoods on the over-exploitation of communal resources, including forests. The scarcity and diminished productivity of land has fostered the expansion of farming onto marginal and degraded lands. Growing demand for farmland also makes it much harder to place significant areas of land under area enclosures.

## **8. The lack of a national strategy and guidelines**

Kassa et al. (2017) argued that the lack of a national strategy and guidelines for rehabilitation efforts has contributed to a number of weaknesses in implementation. They note that because the institutions in charge of enclosures lack a clear strategy to guide the process of establishing and managing them, there have been failures and inconsistencies across sites in terms of several key elements. There has been no consistent approach across sites regarding the procedures followed in site selection, objective setting, engaging communities, and defining net benefit sharing arrangements. Clearly, these are vitally important. It could be argued that approaches need to vary across sites and according to specific local circumstances. Nevertheless, there needs to be a set of common principles and a high degree of coordination and cross-learning across sites, not least to ensure coherence at landscape level. Impacts encompass ecosystems and social and economic effects that go beyond the narrow boundaries of a given enclosure, and any given enclosure will have impacts on, and be impacted by, its neighbours.

Also lacking are planning and monitoring skills and tools for a strategic approach to setting and negotiating objectives, as well as jointly developed management plans. Moreover, there has been a failure to systematically conduct participatory monitoring and evaluation of economic as well as ecological impacts and benefits. Kassa et al. (2017) also observed that there has been a “quasi absence of follow up by concerned government agencies of ... AE [area enclosure] sites after externally funded projects ... are completed”.

## **9. A lack of public investment and incentives for private sector investment**

There have been limited efforts to encourage private sector investment in rehabilitation, and little scope to allocate public funds. The costs of enclosures have largely been borne by the communities themselves. Little public funding has been available to cover the opportunity costs of participating community members, although the donor-supported Productive Safety Net Program (PSNP) has been important in areas where enclosures have been implemented. The question of establishing incentives for the private sector to invest in landscape rehabilitation is a complex one. There may well be trade-offs in terms of equity and other considerations, including land ownership and rights that are difficult to resolve.

Kassa et al. (2017) noted that there have been cases where large tracts of rehabilitated land managed by communities were redistributed to landless youth wanting to take up farming, without the prior, informed consent of the communities. In parts of southern Ethiopia there have been cases where investors acquired land within established forests for coffee production and other commercial uses, in ways that were not transparent and that undermined the rights of local communities. This does not appear to have been a significant problem in Tigray. What is crucial here



is that regional and local authorities engage with communities using transparent, multi-stakeholder processes that aim to promote inclusive business models that enable private investment, without undermining local people's rights, and ensure that the benefits of investments are widely shared. But there are promising new international initiatives that support these aims. Impact investments in sustainable forestry are an important element in the African Forest Landscape Restoration Initiative (AFR100) for example, and Ethiopia will need to develop its own related initiatives.

## **10. Inadequate attention to productivity enhancement and economic returns**

As suggested above, there has been little emphasis on increasing the productivity of landscapes and the incomes of communities in degraded areas under exclosures. Community members report that the benefits they have received have been below their expectations. As has already been noted, there has been no systematic effort to increasing productivity by planting economically productive trees, shrubs and grasses, and natural regeneration has produced a greening that is not optimally supportive of local livelihoods. Moreover, there has been inadequate attention to soil and water conservation measures that would improve the survival and growth rates of seedlings. Conservation objectives have taken precedence over the equally important goal of increasing the productivity of rehabilitated forests and landscapes.

So, while Ethiopian programmes, notably those of Tigray, are widely and justifiably touted as success stories, community members consulted by Kassa et al. (2017) said that exclosures have failed to match their expectations in terms of economic returns, confirmed in surveys during this review. Though it is important to understand that dissatisfaction is not universal, some have benefited more than others, and that aspirations and expectations have shifted greatly over recent decades. Those who remember the 1980s marvel at the positive transformation (e.g. the 2015 'Ethiopia Rising' film, <https://vimeo.com/ondemand/ethiopiarising>), while younger people have come of age in an era of higher living standards and have correspondingly higher aspirations and expectations.

It may well be the case that greater efforts to involve and develop linkages with the private sector could have generated substantial revenues from high value non-timber forest products such as forest coffee (significant in southern Ethiopia), from carbon funds, or from more traditional forest products in Tigray. A growing body of literature (Wuletaw et al., 2019; Yirdaw et al., 2017, Ermias et al., 2017; John et al., 2017; Tigist et al., 2015; Seyoum et al. 2015) emphasise the need to make exclosures and forest protection economically attractive, and this is a central element in the new Forest Law. Still, it is important to note that communities have engaged in these activities in spite of the short-term costs they have incurred, in the anticipation that they will in the medium to long term become the owners of rehabilitated landscapes. Reij et al. (2016) point to studies showing positive returns for exclosures over a period of seven years. But, here, the economic returns have been modest over a longer period, yet the commitment has remained strong. This suggests that economic, pecuniary factors, while important, are not exclusively important. It is generally the case that social or socio-cultural factors underlie and interact with economic factors. In Tigray's land restoration efforts, community cohesion and the sense that the land supports not just livelihoods but also community life, has been key. At the same time, the aspirations of a new generation for higher, more modern living standards, with motivations that are at once socio-cultural and economic, will necessitate new approaches.

## **11. Inadequate net benefit sharing arrangements**

Arrangements for net benefit sharing have been poorly defined. The lack of transparent and negotiated benefit sharing mechanisms has been a source of conflict, and there may be an issue of 'elite capture', with local elites securing a greater share of the benefits. This is more of a problem under participatory forest management in southern Ethiopia where forest revenues have been more concentrated. In Tigray, revenues have been more limited and more dispersed. Still, it is important to ensure transparency, participation in decision-making, and inclusiveness, in developing benefit-sharing mechanisms, while seeking to develop inclusive business models. Here, the collaborative involvement of NGOs, CBOs and local government is vital.

## **12. Inadequate emphasis on income diversification and the promotion of forest-based livelihoods**

The need to diversify local income sources to reduce pressure on land and forests is increasingly recognised. The development of new, enhanced forest-based livelihoods is also seen as important in 'making forests pay' so that livelihoods and forests are positively linked. There have been efforts, under participatory forest management and area exclosures, to promote a wide range of new economic activities including small-scale carpentry, honey production and processing of forest by-products. New funds are now available for enterprise promotion linked to the REDD+ program, but this is relatively new and the scale of such activities is still small.

More broadly, Kassa et al. (2017) argued that at a landscape level, there is a need to promote the integration and complementarity of forest-based and other livelihoods, including climate-smart agriculture, livestock production and apiculture. Here, technological innovations need to accompany policies that promote local enterprise and market integration, under a regulatory framework that prevents over-exploitation. There is also scope to develop programmes that enable communities that protect forest to receive payments for ecological services (PES) from downstream beneficiaries, including the public and private sectors, such as power generating and water companies. Recent policy documents set out how this can be done, but they have not as yet been translated into implementation.

## **13. Limited ownership and follow up by government agencies of rehabilitated landscapes**

Among key informants and CBO leaders consulted by Kassa et al. (2017), there was almost universal agreement that governmental agencies had provided only very limited support to CBOs and for the monitoring and management of rehabilitated landscapes. Post project follow-up and monitoring by relevant governmental agencies has been weak. It is not clear whether or not this relates to a lack of capacity in governmental institutions, or to a failure to recognise the importance of follow-up and monitoring.

## **14. A low level of capacity in communities and community-based organisations**

There is a lack of technical, managerial and administrative capacity at community level for managing forest land under exclosures. This is reflected in the failure to adopt basic practices such as pruning. Developing administrative and organisational capacity is also needed to effectively manage conflicts. So, it is important to build local capacity widely, and to seek cost-effective ways of doing this. The adoption of co-learning and participatory approaches under on-going

programmes will help on the technical side, as will greater involvement of local research institutions in agricultural knowledge systems that involve all stakeholders.

### **15. Inadequate attention to the question of leakage**

Little effort has been made to assess the extent and nature of any leakage, and the potential impacts of displaced activities on neighbouring areas. There is little information on leakages in terms of effects on nearby areas that are not under exclosures. More broadly, it would be useful and important to know what kinds of new activities have been taken up by those displaced by exclosures, and whether there has been an intensification of other forms of land use elsewhere.

### **16. Insufficient use of information technology and analytical tools**

Site selection, the choice of rehabilitation objectives and development of management plans do not always appear to have been informed by the knowledge and experience available from local sources of expertise. There has been little use of GIS mapping in planning and assessing efforts.

### **17. Insufficient attention to knowledge management**

Until fairly recently, there had been a failure to rigorously document and assess experience with participatory forest management and area exclosures, with a view to learning from successes as well as failures, and addressing identified weaknesses. From 2015, CIFOR and related Ethiopian institutions have sought to fill this gap, and there is a growing body of literature, reviews, evaluations and studies aimed at documenting good practice and determining how successful efforts can be scaled up. There had also been a dearth of location and context specific studies identifying options for optimising both ecological and economic outcomes, as well as mitigating leakage and externalities at landscape level. These important aspects are now receiving greater attention, and the existence of relevant research centres in Tigray is significant here. Centres established at Mekelle University for example, have been able to collaborate with national and international partners to conduct studies and analysis of the types described here.

### **18. Fragmentation and the need to establish corridors linking exclosures**

Another challenge in the implementation of exclosures is fragmentation. Under landscape-level interventions covering large areas, people have readily adopted the strategy, and fragmentation has been reduced by landscape level management. Strategies adopted to avoid fragmentation include establishing corridors, conserving propagule sources, and establishing buffer zones. Among these, the most effective is the establishment of corridors that link fragmented patches of exclosures, at the same time enhancing the richness of exclosures in terms of species as corridors link different exclosures each with a distinct forest composition, remnant natural forests, and plantations. Establishing corridors promotes the movement of genetic material, diminishes in-breeding and improves selection and functioning as a tree improvement mechanism.

### **19. Landlessness and rural youth**

Ethiopia's population increases by some two million people annually. The 'youth bulge', a demographic phenomenon produced by a combination of reduced infant mortality and persistently high fertility rates, means that a large share of the population consists of children and young adults. But job creation and the growth of manufacturing and services have not been able to match the growth of the increasingly young population. Travelling around rural Ethiopia and

Tigray, the scale of the challenge is immediately apparent. In every community, there is a growing number of landless youth who have little in the way of economic prospects. Many lack the education and skills necessary for employment outside of traditional agriculture. There is progress and change in this regard, but it is not coming at a pace sufficient to improve the aggregate picture. And, in any case, rural youth have the requisite skills and knowledge for rural livelihoods, and many wish to take up farming. So, the pressure on land continues to increase. The average size of smallholder farms in Tigray is now less than 1 hectare.

But, the restoration of degraded land creates new productive assets, and can provide opportunities for landless youth. Alongside the diversification of local economies, with measures such as the introduction of beehives for honey production, initiatives that promote climate-smart agriculture and agroforestry with enhanced productivity and efficiency, could enable a sustainable expansion of agriculture, while protecting forests. Though there have been efforts to increase youth involvement in the management of exclosures, such that they are recognised as participants as well as beneficiaries.

These issues and the related pressure on land and forests are major concerns for the regional government of Tigray as it is for national policymakers. The urgent need to provide economic opportunities for landless youth may well require a shift in economic policy, and the state-led development model that Ethiopia has pursued means that there is considerable scope for economic liberalisation. But, here, it should be noted that land restoration efforts do not exist in a vacuum. They can only succeed in a context of wider economic progress, accompanied by social development that enables innovation and change. Without this, local successes will be overwhelmed by economic and social failures elsewhere.

The strains are already showing in Tigray, and have been exacerbated by a recent influx of thousands of migrants expelled from the Gulf countries as a result of the COVID-19 crisis. These returnees, whose remittances were supporting many local households, now find themselves suddenly, left without incomes and in a desperate situation, and are demanding to be allowed to make use of land allocated to exclosures.

## **20. The COVID crisis**

The regional government and local civil society have been taking steps to develop an appropriate response to the COVID-19 crisis. Mekelle University staff members (including the lead author of this review) have participated in consultations with local religious leaders in Mekelle and local leaders across Tigray. Effective responses must be designed and implemented in consultation with affected communities. The lockdown has imposed enormous hardship on poorer social groups, and especially those who depend on daily incomes for their subsistence and have no recourse to savings. Consultations with local people and local institutions are urgently needed, to raise awareness and understanding by providing basic epidemiological facts to communities in ways that are easy to understand, and to ask communities to propose their own, locally-suitable methods of transmission control, monitoring and enforcement mechanisms (de Waal, 2020). Here, it is vital to engage with and involve local people, local institutions, and the strong social networks that exist, so that their local knowledge informs a locally-tailored response. There is of course, a danger that the hardships caused by the COVID crisis and associated lockdown will generate new pressure to encroach on exclosures. These can be mitigated by emergency, humanitarian support, and local governments and civil society are collaborating to deliver this, but there is considerable uncertainty and such efforts will need to be sustained.

## 4. A future agenda for land restoration



### **Commitment at local, national and international levels**

Very significantly, there is a high level of commitment to land restoration at the local, national and international levels (Haile and Kindeya, 2001; Nyssen et al., 2004). The people of Tigray have demonstrated their willingness to contribute their labour and forego current incomes to implement exclosures and soil and water conservation measures, and to organise themselves for broader sustainable management efforts (Haile et al., 2001). Land restoration is also seen as fundamentally important at the national level to achieve the government target of restoring 15 million hectares of degraded land by 2030 under the GTP II of 2015, and GoE will rely to a great extent on natural regeneration under areas exclosures. These national efforts aim in turn to fulfil global commitments. Under the Bonn Challenge, there is a target of restoring 150 million hectares by 2020 and 350 million hectares by 2030. As a participant in the 2014 UN Climate Summit, Ethiopia made a commitment to restoring over 30 million hectares of degraded forest land. The Convention on Biodiversity's Aichi targets involve a commitment to restore over 15% of degraded ecosystems by 2020. Ethiopia takes these international commitments seriously, and national policy is closely aligned with international efforts.

The government aims to use the success of exclosures in Tigray as a model for other parts of the country. Here, the management of exclosures, and establishing the appropriate institutional arrangements, is crucial. Lessons from Tigray will inform the roll-out of similar programmes across other regions, but it will be necessary to adapt approaches to local conditions, social as well as environmental. Ethiopia is socially and culturally diverse and each region has a distinct set of social institutions. The Afar Region, neighbouring Tigray, is predominantly pastoral and has its own traditional institutions and natural resource management practices. Afar has also been severely affected by the spread of the invasive tree species *Prosopis juliflora*, and which has



undermined local livelihoods but might present new opportunities and even deliver some ecological benefits. Clearly, methods employed successfully in Tigray cannot be simply transferred to the Afar context without adaptation, and that will involve analysis and a participatory process. In pastoral lowlands including the Somali region in the east, and Borena in the south, there is an urgent need to protect preferred tree species that are vital to local livelihoods in the face of expansive charcoal production. But it will also be necessary to develop approaches that work across vast pastoral rangelands. In southwestern Ethiopia and Oromia, there is an evolving patchwork of livelihoods and distinct forms of social organisation (including the Oromo 'Gadda' system).

### **Improving the implementation of area exclosures**

Recognising the economic and environmental potential of exclosures at national level, the government aims to increase the area of rehabilitated land and land protected under exclosures to over 3 million hectares by 2030 (CRGE, 2011). Regreening using area exclosures has been employed across different forest ecosystems, from dry forests and woodlands to sub-humid afro-montane forests. In 1996, there were only around 143,000 hectares of exclosures in Ethiopia, but by 2011 in Tigray Regional alone, some 895,220 hectares were under exclosures. The area of land under exclosures also grew rapidly in other regional states. By the end of 2013, exclosures covered 1.54 million hectares in Tigray and 1.55 million hectares in Amhara Region. But, there was a lack of information and analysis necessary to develop a sound scaling-up strategy, and a failure to assess identified best practices in exclosure management, adaptations to local conditions that might be necessary, potential impacts, the required enabling conditions, and measures needed to improve productivity.

There is a lack of new, locally validated, exclosure approaches and techniques, with the successful technologies still being the traditional ones. There has been little effort to develop innovative technologies and approaches suitable for the prevailing conditions in different agroecological zones, farming systems and social contexts. This failure to conduct applied research has hindered the development of site-specific exclosure technologies that could solve the particular problems of farmers and resource users across widely differing localities and regions. In Tigray, objective-based development with respect to area exclosures lags far behind other agricultural and forestry sectors in terms of the development of new technologies. There has been an over-reliance on natural regeneration. Research, analysis and information serves are key inputs in the development and scaling-up of programmes that are responsive to, and appropriate for, specific socioeconomic and ecological contexts.

Exclosures typically meet their primary objective, which is rehabilitation. However, there are diminishing returns over time over time, such as the immediate benefits from grass that communities harvest, begins to decrease, and farmers and other stakeholders complain about the modest benefits obtained over long years of exclosure. For local people, exclosures take a very long time to deliver only modest benefits, and this issue must be addressed urgently, if area exclosures are to be maintained.

Community members are not willing to support the further expansion of exclosures as a means of rehabilitation without assurances of economic benefits in the short to medium term. It is now abundantly clear that exclosures must be established and managed with specific economic objectives in mind, and on the basis of site-specific plans that direct regeneration towards commercial ends. To sustain practices that have proven to be effective in restoring land, silvicultural improvement

will be necessary that lead to increased economic returns with identified products, and must be part of management plans for all enclosures.

When an area is selected for enclosure, the economic benefits and products that will be obtained should be defined. These may encompass grass production, fuelwood, apiculture, increased stream flow, new wells, and carbon capture. But they must also include marketable products from which community members can generate incomes in the short to medium term. And this is only possible when the management of enclosures is complemented with appropriate silvicultural practices which must be determined for a given area through research. Identifying and implementing an action-research agenda for each locality and agroecological zone is thus a critically important task.

Experimentation with different silvicultural practices, such as singling, spacing, lopping, pruning, soil cultivation, enrichment planting and thinning, should be directed towards marketable products desired by local communities. This will have to involve flexible, market-oriented processes reliant on trial and error. And this should not assume that it is possible to quickly determine what can be produced at each site. The important point is to establish processes and systems that are backed up by expert knowledge. Such efforts in Tigray could then generate a package of recommendations for the scaling up of enclosures, and extension to other regions with processes and systems that facilitate local adaptation.

## Conclusions

The establishment of enclosures across different agroecological zones presents valuable opportunities for action-oriented research and analysis. Local colleges and research institutions could conduct field excursions for students majoring in natural resources management. Related outreach efforts, part of the mandate of local universities, could help to build local capacity, awareness and understanding around natural resource management.

Involvement in collaborative efforts between students, researchers, local government, and relevant actors in the private sector, as well as local schools, could do much to address identified capacity and economic productivity issues. An adaptive approach of testing innovations with local people needs to be accompanied by efforts to build local capacity, knowledge and understanding, integrating modern and traditional knowledge.

The aim should be to establish frameworks for the participatory development of agricultural knowledge that improves ecological and economic outcomes from restoration activities. And in charting the way forward, it is vital to conduct action-oriented research that supports improved on-the-ground programme implementation.

Given the continuing rapid population growth and intensifying local economic, social and land use pressures, there is an urgent need to accelerate the implementation of tree-based restoration, and this must be based on sound assessments. Research and expert analysis must be combined with the insights of local community members (men, women, and youth), which are vitally important because it is they, the local resource users, who ultimately determine the sustainability of enclosures and other restoration approaches.

An action-oriented research agenda on enclosures, for example, must encompass the following components.

1. A review of existing literature and data on the scale, multiple impacts and broader benefits of enclosures.

2. An assessment of existing community institutions and bylaws governing enclosures, and their enforcement
3. An analysis to determine how much enclosures have contributed to changes in vegetation cover in Tigray, and to disentangle their effects from those of accompanying soil and water conservation measures.
4. A 'tree rights' and user rights assessment comparing different forms of ownership, including individual, communal and cooperative ownership, alongside an analysis of community perceptions on the management and use of enclosures by different land users including farmers, landless households, outsiders, and the role of investors.
5. Technical analyses on the possibilities of introducing enclosure improvement measures and site-specific management plans.
6. Analyses that quantify on-site and off-site benefits of enclosures in terms of, inter alia, honey production, the availability of irrigation water, and grass production.
7. Comparisons of soil depth, soil fertility and soil moisture status of enclosures, compared to soil in nearby agricultural land.
8. Research on the gender aspects of enclosures, gender-specific impacts, and women's involvement in management and governance.

This preliminary review represents just a first step, but provides an outline for the more detailed and rigorous analysis that should follow.

## Challenges and potential response option to scaling up dryland restoration in Ethiopia

Based on the 20 identified challenges arising from this review, the following table presents possible activities that would address these. Further analysis through a more comprehensive and fully participatory review would provide more specific recommendations, including a basis for a consultative process at local regional and national levels, to set out actions needed to establish structures and mechanisms that ensure the sustainable expansion of inclusive and commercially viable land restoration in Tigray and other regions of Ethiopia.

Challenges	Response options	Remarks
Inadequate community participation and a failure to include all local stakeholders	<ul style="list-style-type: none"> <li>• Multi-stakeholder dialogues</li> <li>• Comprehensive stakeholder analysis</li> <li>• Establish new structures and procedures for stakeholder involvement</li> <li>• Capacity building</li> </ul>	<ul style="list-style-type: none"> <li>• Civil society participation alongside local government</li> <li>• Support from international development agencies</li> </ul>
Limited ownership and follow up by government agencies	<ul style="list-style-type: none"> <li>• Comprehensive stakeholder analysis</li> <li>• Establish new structures and procedures for improved stakeholder involvement</li> <li>• Multi-stakeholder dialogues</li> <li>• Training workshops for regional/local government</li> <li>• Consultative workshops with government, community groups and CSOs</li> <li>• Establish agreed guidelines for regular reviews</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building, training, new frameworks for open collaboration</li> </ul>

<p>A failure to manage and exploit trees effectively</p>	<ul style="list-style-type: none"> <li>• Participatory review of planting options and combinations of commercial trees, shrubs and crops</li> <li>• Value chain analysis for identified trees/crops</li> <li>• Training and awareness raising regarding the benefits and commercial opportunities of trees</li> <li>• Develop/revise commercial tree and crop planting plans for different locations</li> </ul>	<ul style="list-style-type: none"> <li>• Technical and participatory analysis (co-learning, co-design)</li> <li>• Capacity building and technical training</li> </ul>
<p>Limited capacity in local communities and CBOs</p>	<ul style="list-style-type: none"> <li>• Capacity building</li> <li>• Training in specific areas identified in an initial study</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building/training</li> </ul>
<p>A failure to plan for promotion of preferred and productive tree species</p>	<ul style="list-style-type: none"> <li>• Capacity building</li> <li>• Training in specific areas identified in an initial study</li> <li>• Multi-stakeholder dialogues</li> <li>• Knowledge sharing</li> </ul>	<ul style="list-style-type: none"> <li>• Technical/participatory learning that draws on local knowledge</li> </ul>
<p>Insufficient use of information technology and analytical tools</p>	<ul style="list-style-type: none"> <li>• Establish a new programme with local research institutions, backed up by international expertise</li> <li>• Deploy new technology in collaboration with local people and their institutions</li> <li>• Establish effective monitoring and evaluation of local impacts/environmental change</li> </ul>	<ul style="list-style-type: none"> <li>• Relies on international expertise at the outset</li> <li>• Crucial to use participatory approaches and build local capacity to understand and use new technology</li> <li>• Build on expanding mobile phone networks</li> </ul>
<p>Insufficient attention to knowledge management</p>	<ul style="list-style-type: none"> <li>• Align knowledge management with research</li> <li>• Develop new mechanisms integrating research and projects, based on open collaboration across government and civil society</li> </ul>	<ul style="list-style-type: none"> <li>• New technical approaches needed to share research outputs with communities and civil society</li> </ul>
<p>Need to determine productivity and develop site-specific management plans</p>	<ul style="list-style-type: none"> <li>• Multi-agency review of production and commercial potential at each site</li> <li>• Value chain analysis</li> <li>• Review of women's economic activities in relation to tree/crop/water management, utilization and benefits</li> </ul>	<ul style="list-style-type: none"> <li>• Tenure/planning</li> </ul>
<p>Uncertainties surrounding land tenure, rights and decision-making</p>	<ul style="list-style-type: none"> <li>• Community empowerment through participatory processes</li> <li>• Analysis and programme design (supported by Mekelle University and CSOs), drawing on experience with participatory land governance</li> </ul>	<ul style="list-style-type: none"> <li>• Participatory approaches to land governance, tenure and planning</li> <li>• Relevant work by ILRI, and PENHA in Somaliland</li> </ul>
<p>Lack of land use planning, and a failure to and define demarcate forest lands</p>	<ul style="list-style-type: none"> <li>• Build capacity on drawing up workable land use plans</li> </ul>	<ul style="list-style-type: none"> <li>• Need to assess farmers land tenure issues and incentives at the outset</li> </ul>

Lack of a national strategy and guidelines	<ul style="list-style-type: none"> <li>Review of policies at regional/national level with a focus on spill over effects on neighbouring countries</li> </ul>	<ul style="list-style-type: none"> <li>Integrated policy research across watersheds, regions.</li> </ul>
Inadequate attention to the question of leakage	<ul style="list-style-type: none"> <li>Assess trade-offs with neighbouring countries</li> <li>Review Tigray-Afar trade-offs in charcoal production</li> </ul>	<ul style="list-style-type: none"> <li>Policy/research</li> </ul>
Limited public investment, and incentives for private sector investment	<ul style="list-style-type: none"> <li>Develop a framework for incentive mechanisms</li> </ul>	<ul style="list-style-type: none"> <li>Policy/finance</li> </ul>
Fragmentation and the need for corridors linking exclosures	<ul style="list-style-type: none"> <li>Policy response based on detailed local analysis</li> <li>Establish participatory planning across watersheds and communities</li> </ul>	<ul style="list-style-type: none"> <li>Environmental</li> </ul>
Persistently high poverty levels and landlessness, in the face of a 'youth bulge'	<ul style="list-style-type: none"> <li>Assess the roles and impacts of youth employment schemes and social protection policies</li> <li>Develop site-specific management plans that address the economic needs of young people</li> </ul>	<ul style="list-style-type: none"> <li>Socio-economic</li> </ul>
Little attention to productivity enhancement and economic returns	<ul style="list-style-type: none"> <li>Build capacity on market links/value chain analysis</li> <li>Collaboration with specialised institutions, local and international</li> </ul>	<ul style="list-style-type: none"> <li>Socio-economic</li> </ul>
Inadequate net benefit-sharing arrangements	<ul style="list-style-type: none"> <li>Review and strengthening of local bylaws</li> <li>Participatory assessments at local level</li> <li>Draw up new benefit-sharing arrangements following a participatory review</li> </ul>	<ul style="list-style-type: none"> <li>Ensure broad and inclusive participation in a comprehensive review</li> </ul>
Limited emphasis on income diversification and forest-based livelihoods	<ul style="list-style-type: none"> <li>Expand opportunities for diversification</li> <li>Value chain studies for specific trees/crops</li> <li>Establish related enterprise promotion/financing</li> </ul>	<ul style="list-style-type: none"> <li>Socio-economic</li> </ul>
Landlessness and rural youth	<ul style="list-style-type: none"> <li>Review land distribution to empower marginalised groups through land ownership</li> </ul>	<ul style="list-style-type: none"> <li>Socio-economic</li> </ul>
The COVID-19 crisis	<ul style="list-style-type: none"> <li>Assess economic stimulus responses at government and macro-levels</li> <li>Close consultation with CSOs and social networks in designing tailored responses and awareness raising</li> </ul>	<ul style="list-style-type: none"> <li>Social networks can greatly enhance locally appropriate COVID-19 response measures</li> </ul>



# References

- Abera, W., Tamene, L., Tibebe, D., Adimassu, Z., Kassa, H., Hailu, H., Mekonnen, K., Desta, G., Sommer, R. and Verchot, L. 2019. Characterizing and evaluating the impacts of national land restoration initiatives on ecosystem services in Ethiopia. *Land Degradation and Development*, 31:37-52.
- Adem, A.A., Mekuria, W., Belay, Y., Tilahun, S.A. and Steenhuis, T.S. 2020. Enclosures improve degraded landscapes in the sub-humid Ethiopian highlands: The Ferenj Wuha watershed. *Journal of Environmental Management*, 270:110802.
- Aerts R., Nyssen, J. and Haile, M. 2009. On the difference between 'exclosures' and 'enclosures' in ecology and the environment. *Journal of Arid Environments*, 73: 762-763.
- Aynekule, E., Mekuria, W., Tsegay, D., Feyissa, K., Angassa, A., de Leeuw, J. and Shepherd, K. 2017. Long-term live-stock enclosure did not affect soil carbon in southern Ethiopian rangelands. *Geoderma*, 307:1-7.
- Balehegn, M., Haile, M., Fu, C., Liang, W. 2019. *Ecosystem-based adaptation in Tigray, northern Ethiopia: A systematic review of interventions, impacts, and challenges*. In: Leal Filho W. (ed.), *Handbook of Climate Change Resilience*. Springer, Cham.
- Berhane, A., Totland, Ø., Haile, M. and Moe, S.R. 2015. Intense use of woody plants in a semiarid environment of northern Ethiopia: Effects on species composition, richness and diversity. *Journal of Arid Environments*, 114: 14-21.
- Besseau, P., Graham, S. and Christophersen, T. 2018. *Restoring forests and landscapes: the key to a sustainable future*. Global Partnership on Forest and Landscape Restoration, Vienna, Austria.
- Biedemariam, M., Hadgu, K., Fenta, A., Ayenkulu, E., Gebrehiwot, K. and Birhane, E. 2017. Landscape level rehabilitation for improved agricultural productivity and ecosystem services in Abreha-we-Atsibeha, northern Ethiopia. *Journal of the Drylands*, 7:633-643.
- Birhane, E., Teketay, D. and Barklund, P. 2006. Actual and potential contribution of exclosures to enhance biodiversity of woody species in the drylands of eastern Tigray. *Journal of the Drylands*, 1(2):134-147.
- Birhane, E. and Hadgu, K.M. 2014. Community-managed exclosures in Tigray, Ethiopia. In: de Leeuw J, Njenga M, Wagner B, Iiyama M. (eds.) *Treesilience: An assessment of the resilience provided by trees in the drylands of Eastern Africa*. World Agroforestry Center, Nairobi, Kenya. 166pp.
- Chirwa, P.W. 2014. *Restoration practices in degraded landscapes of Eastern Africa*. African Forest Forum Working Paper Series, 2(11). 55pp.
- Chukwuebuka C. Okolo, Michaela A. Dippold, Girmay Gebresamuella, Amanuel Zenebe, Mitiku Haile, Ezekiel Bore. 2020. Assessing the sustainability of land use management of northern Ethiopian drylands by various indicators for soil health. *Ecological Indicators*, 112(2020):106092.
- Damene, S., Tamene, L., Vlek, P.L.G. 2013. Performance of enclosure in restoring soil fertility: a case of Gubalافت district in North Wello Zone, northern highlands of Ethiopia. *Catena*, 101:136-142.
- de Waal, A. 2020. COVID-19 in Africa: Know your epidemic, act on its politics. *African Arguments*, 31 March 2020.
- Descheemaeker, K., Nyssen, J., Rossi, J., Poesen, J., Haile, M., Raes, D., Muys, B., Moeyersons, J. and Deckers, S. 2005. Sediment deposition in exclosures in the Tigray highlands. *Geoderma*, 132(3):291-314.
- Descheemaeker, K., Muys, B., Nyssen, J., Sauwens, W., Haile, M., Poesen, J., Raes, D. and Deckers, J. 2009. Humus form development during forest restoration in exclosures of the Tigray Highlands, northern Ethiopia. *Restoration Ecology*, 17(2):280-289.
- Desta, L., Carucci, V., Wendem-Ageñehu, A. and Abebe, Y. (eds). 2005. *Community based participatory watershed development: A guideline*. Ministry of Agriculture and Rural Development, Addis Ababa, Ethiopia.
- Dinku, Y. 2017. *Ethiopia's REDD+ readiness accomplishments have been unanimously endorsed*. Forest Carbon Partnership Facility webpost, 2 August 2017. <https://ethiopiareddplus.gov.et/2017/10/02/ethiopias-redd-readiness-accomplishments-have-been-unanimously-endorsed/>
- Elkington, N. 2019. Her story: *Ethiopia's forest*. Webpost, part of the *Global Comparative Study on REDD+ project*. CIFOR, Addis Ababa, Ethiopia. <https://stories.forestsnews.cifor.org/women-in-ethiopian-forest/index.html#Her-story-Ethiopian-forests-u9rxEfsy5m>
- Gebregerges, T., Tessema, Z.K. and Birhane, E. 2018. Effect of enclosure ages on woody plant structure, diversity and regeneration potential in the western Tigray region of Ethiopia. *Journal of Forestry Research*, 29:697-707.
- Gebrehiwot, T. and Veen, A. 2014. The effect of enclosures in rehabilitating degraded vegetation: a case of Enderta district, northern Ethiopia. *Forest Research*, 3(2).
- Gebremedhin, B., Pender, J. and Tesfay, G. 2003. Community natural resource management: The case of woodlots in northern Ethiopia. *Environment and Development Economics*, 8:129-148.

- Gebremedihin, K.M., Birhane, E., Tadesse, T. and Gbrewahid, H. 2018. Restoration of degraded drylands through exclosures enhancing woody species diversity and soil nutrients in the highlands of Tigray, northern Ethiopia. *Nature Conservation Research*, 3(1):1-20.
- Gebremeskel, G., Gebremicael, T.G. and Girmay, A. 2018. Economic and environmental rehabilitation through soil and water conservation, the case of Tigray in northern Ethiopia. *Journal of Arid Environments*, 151:113-124.
- Gebreselassie, S., Kirui, O.K. and Mirzabaev, E. 2016. *Economics of land degradation and improvement in Ethiopia*. In: Nkonya, E. Mirzabaev, A. and von Braun, J. (eds.), *Economics of Land Degradation and Improvement – A Global Assessment for Sustainable Development*. Springer International, Basel, Switzerland. pp401-430.
- Gebbru, B. M., Wang, S. W., Kim, S. J. and Lee, W.-K. 2019. Socio-ecological niche and factors affecting agroforestry practice adoption in different agroecologies of southern Tigray, Ethiopia. *Sustainability*, 11:3729.
- Gessesse, T.A., Khamzinab, A., Gebresamuela, G., and Amelung, W. 2020. Terrestrial carbon stocks following 15 years of integrated watershed management intervention in semi-arid Ethiopia. *Catena*, 190:104543.
- Girmay, G.; Singh, B.R.; Nyssen, J.; Borrosen, T. 2009. Runoff and sediment-associated nutrient losses under different land uses in Tigray, Northern Ethiopia. *Journal of Hydrology*, 376(1-2):70-80.
- Hagos, F., Pender, J. and Gebreselassie, N. 1999. *Land degradation in the highlands of Tigray and strategies for sustainable land management*. Socioeconomic and Policy Research Working Paper No. 25. ILRI, Addis Ababa, Ethiopia. 73pp.
- Haile, M. and Gebrehiwot, K. 2001. Local initiatives for planning sustainable natural resources management in Tigray, northern Ethiopia. *Ethiopian Journal of Natural Resources*, 3:303-326.
- Haile, M., Away, F. and Waters-Bayer, A. 2001. *Joining forces and celebrate local innovation in land husbandry in Tigray, Ethiopia*. In: Reij, C. and Waters-Bayer, A. (eds.), *Farmer Innovation in Africa: A Source of Inspiration for Agricultural Development*. Earthscan Publications Ltd., London, pp58-72.
- Haile, M. 2016. *Major environmental problems, challenges and future research direction of Ethiopia with focus on Tigray*. Official Inauguration Workshop of the Mekelle Environment and Forest Research Centre, 5 March 2016, Mekelle University, Ethiopia.
- ICRAF. 2018. *Impact assessment of enhancing integrated watershed management with climate smart agriculture at Gergera Watershed in Tigray, northern Ethiopia*. World Agroforestry Center, Nairobi, Kenya.
- Kassa, H., Birhane, E., Bekele, M., Lemenih, M., Tadesse, W., Cronkleton, P., Putzel, L. and Baral, H. 2017. Shared strengths and limitations of participatory forest management and area exclosure: Two major state led landscape rehabilitation mechanisms in Ethiopia. *International Forestry Review*, 19(S4).
- Lanckriet, S., Derudder, B., Naudts, J., Bauer, H., Deckers, J., Haile, M. and Nyssen, J. 2014. *The impact of land tenure on land degradation: a case study in the north Ethiopian highlands*. Book of Abstracts, Day of Young Soil Scientists, 9 February 2014. Brussels, Belgium.
- Mekuria, W., Veldkamp, E., Haile, M., Nyssen, J., Muys, B. and Gebrehiwot, K. 2007. Effectiveness of exclosures to restore degraded soils as a result of overgrazing in Tigray, Ethiopia. *Journal of Arid Environments*, 69:270-284.
- Mekuria, W., Veldkamp, E., Haile, M., Gebrehiwot, K., Muys, B. and Nyssen, J. 2009. Effectiveness of exclosures to control soil erosion and local community perception on soil erosion in Tigray, Ethiopia. *African Journal of Agricultural Research*, 4(4):365-377.
- Mekuria, W., Veldkamp, E. and Haile, M. 2011. Restoration of ecosystem carbon stocks following exclosure establishment in communal grazing lands in Tigray, Ethiopia. *Soil Science Society of America Journal*, 75(1):246.
- Mekuria, W. and Veldkamp, E. 2012. Restoration of native vegetation following exclosure establishment on communal grazing lands in Tigray, Ethiopia. *Applied Vegetation Science*, 15(1):71-83.
- Mekuria, W. and Aynekulu, E. 2013. Exclosure land management for restoration of the soils in degraded communal grazing lands in northern Ethiopia. *Land Degradation and Development*, 24:528-538.
- Mengistu, T., Teketay, D., Hulthen, H., and Yemshaw, Y. 2005. The role of exclosures in the recovery of woody vegetation in degraded dryland hillsides of central and northern Ethiopia. *Journal of Arid Environments* 60(2):259-281.
- Mengistu W., Kebede, F., Bedadi, B and Birhane, E. 2018. Exclosures backed up with community-based soil and water conservation practices increased soil organic carbon stock and microbial biomass carbon distribution, in the northern highlands of Ethiopia. *Chemical and Biological Technologies in Agriculture*, 5(12).
- MoEFCC,. 2017. *Ethiopia forest sector review*. Ministry of Environment, Forest and Climate Change, Addis Ababa, Ethiopia.
- Nedessa, B.; Ali, J.; Nyborg, I. 2005. *Exploring ecological and socio-economic issues for the improvement of area enclosure management: A case study from Ethiopia*. DCG Report No. 38. Drylands Coordination Group (DCG), Oslo, Norway.
- Nyssen, J., Poesen, J., Haile, M., Moeyrsons, J., Deckers, J. and Hurni, H. 2009. Effects of land use and land cover on sheet and rill erosion rates in the Tigray highlands, Ethiopia. *Annals of Geomorphology*, 53(2):171-197.

- Nyssen, J., Poesen, J. and Deckers, J. 2009. Land degradation and soil and water conservation in tropical highlands. *Soil and Tillage Research*, 103:197-202.
- Nyssen, J., Poesen, J., Moeyersons, J., Deckers, J., Haile, M. and Lang, A. 2004. Human impact on the environment in the Ethiopian and Eritrean highlands: A state of the art. *Earth-Science Review*, 64:273-320.
- Nyssen, J., Haile, M., Naudts, J., Munro, N., Poesen, J., Mpeyersons, J., Frankl, A., Decker S.J. and Pankhurst, R. 2009. Desertification? Northern Ethiopia re-photographed after 140 years. *Science of the Total Environment*, 407:2749-2755.
- Okolo, C.C., Dippold, M.A., Gebresamuella, G., Zenebe, A., Haile, M. and Bore, E. 2020. Assessing the sustainability of land use management of northern Ethiopian drylands by various indicators for soil health. *Ecological Indicators*, 112:106092.
- Reij, C. and Garrity, D. 2016. Scaling up farmer-managed natural regeneration in Africa to restore degraded landscapes. *Biotropica*, 48(6):834-843.
- Rossiter, J., Minale, M.W., Andarge, W. and Twomlow, S. 2017. A communities Eden – grazing enclosure success in Ethiopia. *International Journal of Agricultural Sustainability*, 15(5).
- Seyoum, Y., Birhane, E., Kassa, H., Hagazi, N., Esmael, N. and Mengistu, T. 2015. *Enhancing the role of the forestry sector in Ethiopia: Strategy for scaling up effective forest management practices in Tigray Region with emphasis on area enclosures*. Center for International Forestry Research, Addis Ababa, Ethiopia.
- Seyoum, Y., Mengistu, T., Birhane, E., Esmael, N., Hagazi, N. and Kassa, H. 2015. *Area enclosures*. In: Kassa, H., Tadesse, W., Alem, S., Teshome, B. and Garede, E. (eds), *Book of Abstracts on Agroforestry, Area Enclosure, Participatory Forest Management, Management of Dry Forests and Plantations*. CIFOR, Addis Ababa, Ethiopia.
- Seyoum, Y.; Birhane, E.; Hagazi, N.; Esmael, N.; Mengistu, T.; Kassa, H. 2015. *Enhancing the role of the forestry sector in building climate resilient green economy in Ethiopia: Scaling up effective forest management practices in Tigray National Regional State with emphasis on area enclosures*. CIFOR, Addis Ababa, Ethiopia.
- Seyoum, Y. 2016. *Forest landscape restoration experiences in Ethiopia*. Paper presented at the First Regional Conference of the African Forest Landscape Restoration Initiative (AFR100), 11-12 October 2016, Elilly International Hotel, Addis Ababa, Ethiopia.
- Tebebu, T.Y., Steenhuis, T.S., Dagne, D.C., Guzman, C.D., Bayabil, H.K., Zegeye, A.D., Collick, A.S., Langan, S., McAllister, C., Langendoen, E.J., Yitafaru, B. and Tilahun, S.A. 2015. Improving efficacy of landscape interventions in the (sub) humid Ethiopian highlands by improved understanding of runoff processes. *Frontiers in Earth Science*, 3:49.
- Vieira, D. and Scariot, A. 2006. Principles of natural regeneration of tropical dry forests for restoration. *Restoration Ecology*, 14(1):6.
- Yayneshet, T. 2011. Restoration of degraded semi-arid communal grazing land vegetation using the enclosure model. *International Journal of Water Resources and Arid Environments*, 1:382-386.
- Yayneshet, T., Eik, L. and Moe, S. 2009. The effects of enclosures in restoring degraded semi-arid vegetation in communal grazing lands in northern Ethiopia. *Journal of Arid Environments*, 73:542-549.
- Yirdaw, E., Tigabu, M., Monge, A. 2017. Rehabilitation of degraded dryland ecosystems – review. *Silva Fennica* 51(1B):1673.





Tropenbos International (TBI) envisions a future in which forests and trees are used sustainably for the benefit of local people and the global community. By making knowledge work for forests and people, Tropenbos International contributes to inclusive and evidence-based decision making for the improved management and governance of tropical forests. TBI's longstanding local presence and ability to bring together local, national and international partners makes it a trusted partner in sustainable development.

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## Pastoral & Environmental Network in the Horn of Africa

PENHA is a regional NGO, combining grassroots project implementation with research and policy analysis, focusing on rangelands and dry forests, governance and gender. The team working with TBI is led by Mitiku Haile, Professor at Mekelle University and PENHA Senior Advisor, alongside Amsale Shibeshi, Regional Programmes Coordinator, and John Livingstone, Regional Policy and Research Officer. PENHA was established in 1989 by concerned professionals from Horn countries, registered in the UK and with offices in Addis Ababa, Hargeisa and London.

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