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Article

Key success factors for landscape restoration and economic development using exclosures in Tigray, Northern Ethiopia

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Abstract: For decades, and in line with global initiatives, Ethiopia has made persistent efforts to reclaim its degraded lands into ecologically and socioeconomically plausible enterprises through the exclosure establishment. Tigray, a region in Ethiopia, has been a key actor in the implementation of exclosures, with immense experiences and innovations for others to learn. The region was recognized internationally and won a gold medal for its "Best Future Land Policy" in 2017. To enhance success of exclosure as a restoration strategy, deeper evaluation of critical factors is crucial. For the first time, we assessed exclosures against key success factors of land restoration through detailed discussions with 76 Key Informants and five focus groups in 19 villages of Tanqua-Abergele district of Tigray. The factors include the objective of establishment, restoration approaches, pre-exclosure land-use, levels of degradation before establishment, spatial and temporal distribution, availability of command area, time elapsed to conserve and presence of conflicts in view of understanding what attributes are in support of or missing for economic and ecological development. Analysis of restoration approach revealed that 30%, 20% and 50% of the exclosures were natural regeneration, soil and water conservation only and plantation, respectively. We found out that more than 60% of the recruited exclosures were severely degraded during establishment and calculated that 54.4% were established to comply with regional plans, 34.4% for the development of grass, water and farmlands and 10 % to buffer communal resources. While 70% have command areas, only 7% started irrigation schemes. We proved that 28, 64 and 66 sites did not meet objectives, experienced illegal grazing and tree cutting, respectively. While 75 sites are linked to another village, district or region, only five administrative units collaborated to work for a common interest and 17% experienced conflicts. We conclude that pre-establishment assessment was not properly conducted which is critical for successful exclosure development and decision on type of exclosures, their management and objective evaluation of progresses. We recommend a detailed characterization of future recruitment of degraded lands for restoration programs, considering that the land is suitable for sustainable ecological and socioeconomic development of the local population.

Keywords: characterization, command area, economic development, exclosure, hydrological linkage, landscape restoration

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1. Introduction

In Ethiopia's political and development endeavours, 1991 marks a pivotal moment for the rehabilitation of degraded lands. The large-scale establishment of exclosures as a rehabilitation strategy began after 1991 following the fall of the Derg regime in the country, although unsuccessful attempts had been made before it [1-4]. Shortly afterwards, massive exclosure establishment has been a continuous practice for the past three decades in Tigray [5, 6]. Accordingly, focused studies on success stories were tremendous out of which sustaining and scaling-up mechanisms were devised [7, 8]. For example, only 715.78 (4.12%) hectares were recruited in the Tanqua-Abergele district prior to 1991, when

the Tigray region was under the rebellion rule of the Tigray People Liberation Front (TPLF). Immediately after 1991, there was a large-scale expansion of exclosures, which reached peak in 2000-2010 and slightly decreased towards 2018 (Fig. 2 (a)) due to reasons related to exclosure sustainability [9].

Proper characterization of the exclosures is vital before scaling-up of the practice is proposed. In this study, we attempt to characterize exclosures taking defined attributes useful to be considered for successful implementation and scaling-up practice. We analyzed, for the first time, objective of establishment, restoration approaches, pre-exclosure land use, level of degradation during establishment, spatial and temporal distribution, availability of command area, time elapsed to conserve, presence of conflicts and sustainability problems in view of understanding what attributes are in support of and are missing for sustainable development (Table 1). This would be a useful step to get a broad perspective on land suitability for landscape restoration and economic development in the country and other dryland areas where countless restoration initiatives are prevailing.

Table 1. Description of Variables used to analyze the exclosure establishment and management practice in Tanqua-Abergele District of Tigray

Explanatory Variable	Description
Objective of establishment	Anticipation of the local community about what a site would achieve after its full recruitment as an exclosure as the potential of the site
Restoration approach	Whether an exclosure area was rehabilitated through (1) natural regeneration or (2) aided with construction of soil and water conservation structures or (3) assisted natural regeneration
Pre-exclosure land use	Category of land use before recruitment of an area to an exclosure
Level of degradation during establishment	Degradation status of an exclosure (no, light, moderate, severe or very severe) before the inception
Spatial and temporal distribution	Geographical location and year of recruitment of an exclosure
Availability of command area	Presence of a level land that can be used for irrigated crop, vegetable, fruit or forage development if exclosure projects enhance the availability of water
Time elapsed to conserve	Duration taken to finalize construction of soil and water conservation structures and/or vegetation enrichment of a delineated site.
Presence of conflicts	Whether the spatial distribution results in conflicts between/among villages, districts or regions

2. Materials and Methods

2.1. The Study Area

Tanqua Abergele district, the research area, is located 120 km west of the regional capital Mekelle. It shares borders with Kolla Tembien, Dequ'a Tembien and Samre districts to the North, Northeast and the South respectively, and with Amhara Regional State to the West. It is found in the lowland zones with altitude range of 932-2,394 metres above sea level. The district land administration office estimated 144,564 hectares of total land area with land-use land-cover categories of 5,466, 39740, 2,433, and 32,986 hectares being irrigation, rain-fed, pasture and exclosure areas, respectively. The remaining 63,939 hectares comprise mountains, grazing lands, settlement areas and other miscellaneous lands. From a hierarchical standpoint, the district embraces 20 villages and 80 hamlets. In Ethiopia, the Regional States function similarly to states in the United States, with regions further divided into zones, which are then organized into districts. Each district consists of villages, referred to as 'Kebeles' in Amharic and 'Tabias' in Tigrigna. The smallest administrative unit is a hamlet, known as 'Kushet' in Tigrigna, which collectively forms villages. With the potential for agriculture and pasture growth, the area features several seasonal and permanent rivers. It recruited 113 different types of exclosures as of 2018 covering 12.62% of the total land area of the district. Each hamlet contains seven exclosures on average, ranging in size from 1.38% to 51.62% of the total land area.

The average annual rainfall varies between 580 to 750 mm, typically erratic and poor distribution in space and time. The average temperatures range from 18 to 24°C. The climate is favourable for major crops like sorghum, maize, teff, finger millet, sesame, groundnut and some spices and vegetables. Fruits like orange, mango, lemon, tangerine, banana, and java grow well. It has tree species vegetation composed of *Terminalia brownie, Acacia senegal, Acacia lahai, Ziziphus spina-christi, Dichrostachys cinerea, Balanites aegyptica, Ximenia americana, Cordia africana, Cordia monoica, Cordia uncinulata, Acacia oerfota and Albiza amara*. Vertisols, Aridisol and Alfisols dominate the soils of the district. According to the district agricultural Office, the soil textural types are silt, loam, sandy, clay and silt loam, in order of area coverage.

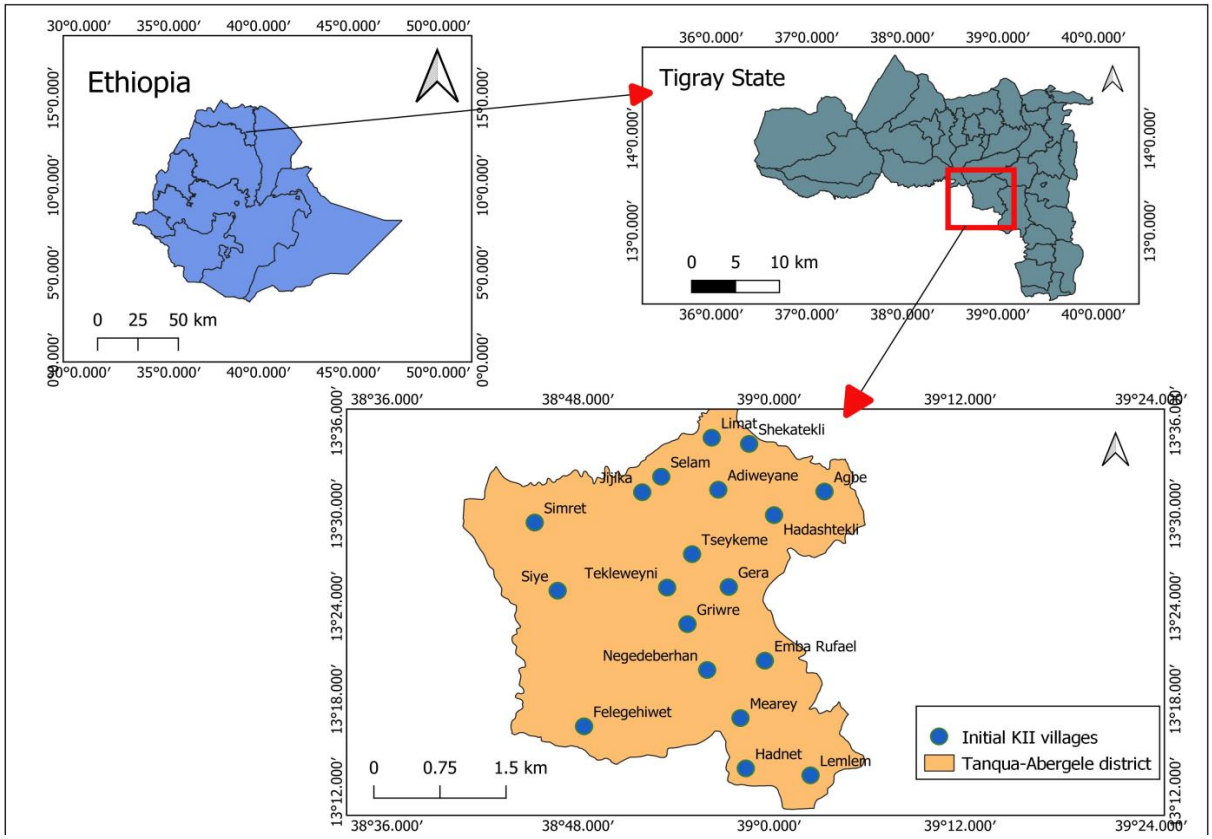

Figure 1. Location of study area (Tanqua-Abergele) and its relative location (region, district and villages) where KII was held to understand characteristics and situation of exclosures.

The total livestock population of the district is 268,266, equivalent to 73,430 Tropical Livestock Units (TLU), of which 116,744 are small ruminants. The district is endowed with a large area of grazing as a result 40-60% of the people make a living on livestock production. The dominant livestock production system is mixed in which sheep, goats and cattle are either seasonally or daily moved in search of feed and water [10]. Tanqua Abergele district is exceptionally known for its livestock population and some farmers own up to 500 livestock heads. Export-oriented slaughterhouse has been established by Abergele International Livestock Development PLC to utilize this endowment through export oriented economic development. Ruminant animals were typically acquired from local farmers and were fattened for an average duration of three months using grass feeding and nutritional supplements. Those animals that met export standards were processed for slaughter by the company in Mekelle, the capital of the Tigray Regional State. The hides and skins were then utilized for leather production at a sister company known as Sheba Leather Factory, situated 45 kilometres from Mekelle. The district is inhabited by a total human population of 92,888 with 51% female and 49% male, with an annual growth rate of 2.7%.

2.2 Data Collection and analysis

Tanqua-Abergele was systematically selected for this study being one of the districts in which the Sustainable

Land Management Programme (SLMP) has been implemented by the government since 2008. A total inventory of all exclosures established before 2019 was conducted in 19 villages of Tanqua Abergele district. Data was collected from Focus Group Discussions (FGD), 76 Key Informant Interviews (KII) and content analysis of documents, project plans and reports. Descriptive statistics (averages and percentages) were used to analyze data. Data was analyzed using STATA 16 and presented in tables and graphs.

3. Results

3.1. Temporal and Spatial Distribution of Exclosure Types in Tanqua-Abergele District

The exclosures established in the Tigray region were broadly categorized into three. Natural regeneration exclosures (ENR) would be the first portion. These areas were solely shielded from animal and human influence, such as tree cutting, grazing and other human activities. It was expected that repressed plants and seeds and seeds within soil seed banks would spontaneously re-grow in this type of exclosure without the need for any other extra interventions. This approach is useful for an instant action because it is a cost-effective and speedy way to establish an exclosure to meet some defined objectives. The second type of exclosure demands the the construction of Soil and Water Conservation Structures (SWCS) to halt severe erosion in addition to protection from human and animal interference (ECNR). A third type of exclosure was a practice of relatively integrated management including construction of SWCS, plantation with nursery-raised seedlings and protection from human and animal interference (ECP). As a result, we calculated the percentage of exclosure types in the Tanqua-Abergele district by area covered (ha), and found that 30%, 20%, and 50%, respectively, come under ENR, ECNR, and ECP (Fig. 3 (a)).

We also looked into whether each exclosure was selected to achieve particular community objectives. The detailed reactions of the Key Informants are presented in Table 2. According to KIs, the largest proportion (54%) of the exclosures was established to comply with the national and regional exclosure development plans in a quota system. The second largest proportion of exclosures (34%) was established targeting local development programs like grass for animals and thatching, protection of economically important plant species, development of spring water and healing farmlands by treating erosion-induced gullies. Exclosure areas with a share of 11% were established to buffer some adverse effects on different community resources including rivers adjacent to farmlands, protect grazing by herds from another village, protect churches and tombs, buffer settlement areas and farmlands from upstream flooding and proof of ownership. A small part (approx. 1%) was assigned for private fattening through formal investment and research works on agriculture and natural resources thematic areas.

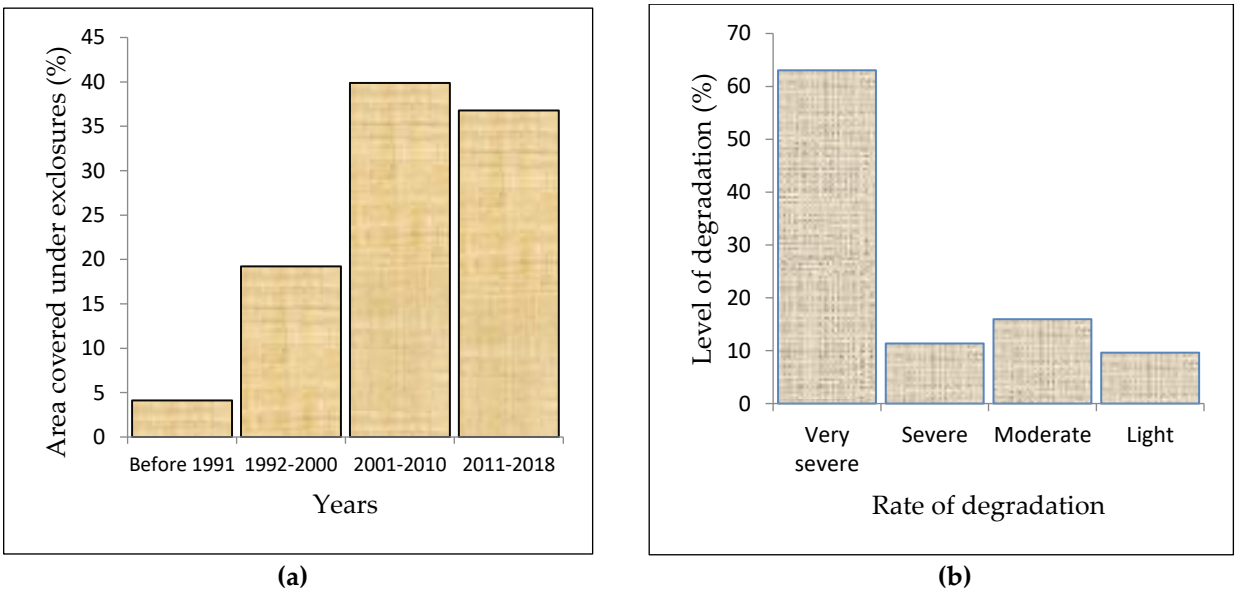

Figure 2. (a) Exclosure Establishment; (b) level of degradation during recruitment of exclosures in Tanqua-Abergele district, compiled from key informants.

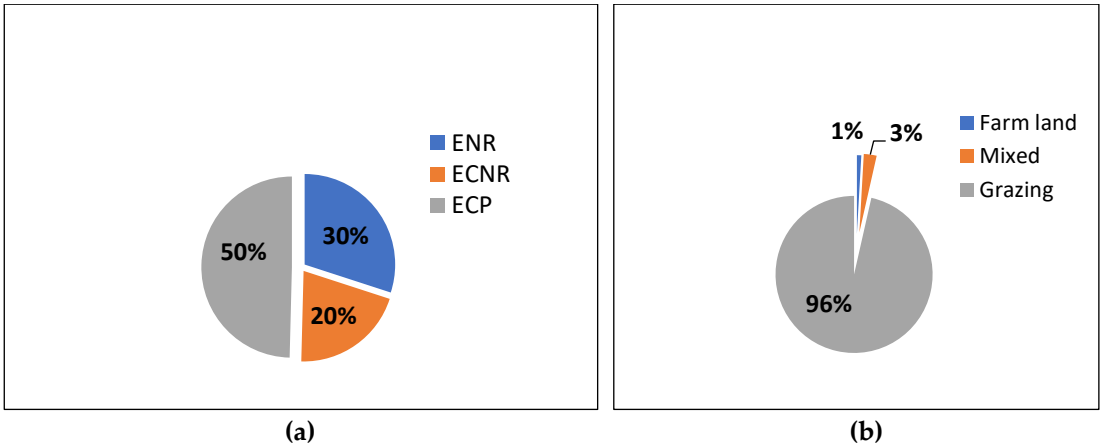

Figure 3. (a) Type of Regeneration; (b) land use of exclosures during establishment in Tanqua-Abergele district of Tigray, compiled from Key Informants.

The highest proportion of the exclosures (96%) was established on communal grazing lands, 2.6% on mixed areas and only 0.9% on farmlands (Fig. 3 (b)). The evel of degradation at the time of exclosure establishment was light (9.63%) with only surface sheet erosion, moderate (15.96%) where rills were seen, severe (11.37%) in which small gullies and exposed plant roots were visible while the rest (63.04%) was very severe in which big gullies and landslips were observed. Exclosures intervened with Soil and Water Conservation Structures took 2.58 years on average with a maximum reaching 8 years to be completed. Similarly, the frequency of plantation in exclosures was 5.58 years on average with the maximum being 28 years.

Table 2. Response of KIs on objective of exclosure establishment in Tanqua-Abergele district of Tigray

Purpose of establishment	Number of sites*	Area	
	N	Ha	%
Compliance to Regional Plan	66	9453.41	54.39
Grass, Water and Farmland development	36	5946.12	34.21
Buffer and Protect Community Resources	9	1842.48	10.6
Research and Investment	2	140	0.81
Grand total	113	17382.01	

*Land areas characterized by a single type of regeneration are referred to as sites. A site may be classified as ENR, ECNR, or ECP.

Long-term exclusion of animals and human interventions from protected areas can increase springwater development especially when the establishment objectively considers such factors. We collected information on the availability of command areas that can be described as main economic development zones through crop and animal farming (Table 3). Accordingly, 79 sites have farmlands, 20 sites have no command areas and 9 sites immediate drain to rivers without crossing level grounds. During the data collection period, 52 sites were being used as rain-fed crop production areas, and eight sites had a few scattered fruit trees. Moreover, integrated farming had been undertaken in eight sites and some scattered patches of irrigation plots were observed in 12 sites, targeting subsistence vegetable production.

Table 3. Type, size and current use of exclosure command areas, Tanqua-Abergele district of Tigray, Northern Ethiopia

Type of commend area	Command Area		Size of command area			Current use of command area		
	N	A(%)	Size	N	A(%)	Use	N	A(%)
Farmland	79	69.91	***	4	3.54	F	52	46.02
Farm and Grazing	5	4.42	**	68	60.17	FG	12	3.54
No command area	20	17.7	NA	29	25.66	FGI	8	7.08
Flow to a River	9	7.96	*	12	10.62	FSI	12	10.62
						NA	29	25.66
Total	113	100		113	100		113	100

N (number of sites); A (size of the command area); * (Small), ** (Medium), *** (Large); NA (Not Applicable as there is no defined command area); F, FG, FGI and FSI represent Farmland, Farmland and Grazing, Farmland and Good Irrigation, Farmland and Small Irrigation.

Exclosures linked with other neighbouring regions, districts and/or villages were five, 16 and 54 sites, respectively (Table 4). We asked if exclosure-connected administrative units cooperate to construct SWC structures and protect exclosures from any illegal acts. Unfortunately, only five sites have contributions from the bordering administrative units in the development and management of exclosures. According to respondents 63.73 and 59.19% of the exclosures were challenged by illegal grazing and tree cutting while 17.15% triggered conflicts among neighbouring community members. Illegal and continuous tree cutting and grazing have been serious problems facing exclosures, which ultimately resulted in the abandonment of many exclosures. Accordingly, the district established 24,304.23 hectares of exclosures but 7,003 (29%) were not recognized as exclosures by the local administration. More worrisomely, there were exclosure areas whose restoration outputs primarily benefit nearby villages. Conflicts were noticed in these situations where use and management rights were under different bodies.

3.2. Exclosures objective, illegal grazing and tree cutting and Conflicts

According to KIs, 64% and 59% of the exclosures were challenged by illegal grazing and tree cutting while 17% triggered conflicts among community members. We found out that the setting of objectives at the time of establishment was not participatory. If community members were fully engaged, they could have prioritized other effective exclosures in terms of suitability for ecological and economic development.

Table 4. Response of KIs (Resp.) on meeting of exclosure objectives and presence of illegal acts, administrative link and conflicts in terms of area coverage (%) and number of sites (N) in Tanqua-Abergele District of Tigray, Northern Ethiopia

Resp.	Illegal Grazing		Illegal Tree Cutting		Link			LAU WT*	Conflicts	
	A	N*	A	N*	Reg.	Dis.	Vi.		A	N
No	36	47	41	50	108	97	59	65	83	100
Yes	64	66	59	63	5	16	54	5	17	13
Total	100	113	100	113	113	113	113	70	100	113

* LAUWT if linked units (Region, district or village) work together (Note 43 exclosure sites are not applicable as they were not linked to other administrative units)

4. Discussion

4.1. Temporal and Spatial Distribution of Exclosure Types in Tanqua-Abergele District

It was revealed that a miniature of land was covered by exclosures before 1991 when majority of the Tigray region had been governed by Tigray People's Liberation Front (TPLF) [11]. On community grazing lands, nevertheless, a series of expanding exclosure establishments occurred after that period (Fig. 2 (a)). Similar to the current study [3] and Yami et al. [12] reported an increase in the extent of the exclosures in Tigray following the downfall of the

Derg regime, which ruled Ethiopia from 1974 to 1991. The exclosure establishment peaked between 2000 and 2010, although it started to decline gradually by 2018 (Figure 2 (a)) due to constraints related to exclosure governance and law enforcement [13]. Farmers indicated that the general trend of exclosure establishment has not continued at the pace it started and swapping of a particular area between exclosure and grazing land has been a phenomenal occurrence.

Currently, 12.62% of the district's average land area is exclosed. There are variations among villages with the village of Giriwre having the lowest (1.38%) while Hadnet has the most (51.62%) coverage. This is in agreement with [3] who reported that the region's exclosure showed a wider variation between one and seven hundred hectares. Moreover, Mekuria and Aynekulu [8] found 3-16% of exclosure coverage in their study in four districts of Tigray. The significant differences in the extent of restored areas across various administrative units suggest that the establishment of exclosures continues to adhere to a quota system implemented from the top down, and has not yet been firmly established as a systematic practice within villages. Had villages been empowered and restoration been an agreed goal, figures would have been consistent among villages and time horizon. This further explains the reason for sustainability challenges facing those already established exclosures. Top-down implementation and management of restored areas can compromise conservation efforts [14] and are usually not effective [15]. The top-down approach still dominates in Africa although some examples of translations to local government [16] were reported. Similarly, local government empowerments were communicated in China [17]. However, there is much practical evidence that the top-down approach is still a dominant system in Ethiopia [18-22] negatively affects restoration regimes. The bottom-up system was reported as a better social-ecological fit [23] as an outcome of their study on restored river governance. Bottom-up planning, implementation and evaluation were also reported as successful in Brazil [24]. A bottom-up and top-down integrated restoration planning approach was recommended by [25] who reviewed different papers. Although considerations were not taken into account by the regional authority, communities at the grassroots level attempted to link certain criteria for selecting specific sites for forest development after quotas were submitted within the framework of a top-down approach. Inherent top-down and bottom-up integration arose, which necessitated standardization of the existing system.

The three categories of exclosures, ENR, ECNR, and ECP, have been measured to cover areas proportionally at 30%, 20.4%, and 49.6%, respectively. There is a large variation between villages in terms of the type of exclosure established on degraded community lands. Often, ECNR develops inadvertently during times of shortage of seedlings to plant and seeds to sow, leaving some areas bare after the construction of soil and water conservation facilities. Restoration schemes can be generally established as natural or artificial [26, 27] regeneration. At Tigray, we note a distinctly broad category of three exclosures. The first is the natural regeneration of vacant lands that are protected only from human and animal interference such as the felling of trees, movement of people inside and grazing (ENR). The establishment of this typology assumes that the ENR can benefit from the regenerative potential of naturally available suppressed plant species and the soil seed banks of protected parent plants without further intervention. It is economically feasible and very useful when immediate local action is necessary to enhance vegetation [28, 29]. The second type of exclosure (ECNR) allows for the construction of soil and water conservation structures (SWCS) to prevent severe erosion in addition to ENR interventions. The third type of exclosure is a management practice that combines the planting of seedlings and enrichment with different plant seeds of the ECNR resulting in another type of forest hereafter referred to as ECP. The three methods of forest regeneration are expected to differ in ecological and socioeconomic impacts. A meta-analysis of 133 studies by Crouzeilles et al. [30] confirms that natural regeneration surpasses active restoration in biodiversity and vegetation structure. A similar report [31] indicated that natural regeneration has the potential to be better for forest regeneration, biodiversity and carbon storage than active restoration. Evans et al. [32] revealed that natural regeneration is twice as likely to sequester carbon as tree plantation in Queensland. Moreover, Holl [33] recommended natural regeneration as the best approach to restoring tropical forests. The aforementioned evidence affirms that natural and active restoration approaches are expected to diverge in their ecological and economic impacts. Research and development practices can focus on the selection of appropriate sites, regeneration approaches and spatial distribution of exclosures which are in harmony with the potential for ecological and socioeconomic development.

4.2. Objective of exclosure establishment

A more thorough evaluation of each chosen area's compliance with specific community goals and whether those objectives were compatible with the social, economic, and environmental advancement of the local populace revealed interesting outcomes (Table 2). Surprisingly, most exclosures were created to fit national and regional forest development plans under the quota system. This implies that the focus was on conservation with no clear goals on other sustainability pillars such as economic and social benefits for local people, given the priority of regional and national governments is to address degradation [34]. This further confirms the popularity of the top-down approach in the region. Members of the local community who were interviewed said that the top-down method to establishing exclosures wastes a lot of resources since there was no proper and participatory site selection, did not meet the aims of the community and failed to take strong protective measures. More often than not, exclosures are susceptible to partial grazing, destruction of soil and water conservation structures, illegal harvesting of produce, or complete destruction and conversion to grazing. As exclosure quotas [19] are either accompanied by food aid [35] to integrate environmental and local development or administratively decided figures [19], villages are mostly engaged in a vicious circle of deforestation ↔ reestablishing ↔ deforestation. Illegal grazing [36, 37] and tree cutting [35] were reportedly mentioned to have adverse effects on the vegetation and soil [36]. Studies that reportedly proved the success stories including improvement in soil chemical and physical properties [38], vegetation parameters and water development [39-41] on exclosure than adjacent grazing areas are outcomes of avoiding some level of illegal grazing and tree cutting [42]. Reversing exclosures back to illicit and unplanned grazing and tree cutting is just enabling the drivers of environmental resource depletion into action. Therefore, exclosures established under the regional premises and motivations of conservation to address degradation issues alone were unsuccessful.

The second largest proportion of exclosures was established targeting local development programs like grass for animals and thatching, protection of economically important plant species, development of spring water and healing farmlands by treating erosion-induced gullies. This category benefits from interventions from NGOs and is usually organized under the concept of watershed management, the potential for targeted woody plant species and grass. Construction of important SWC structures, hiring of guards, and attempting to connect to the command areas are key features that make their fate better than other categories. Important problems affecting the sustainability of these exclosures are unplanned and sudden withdrawal of guards and handover to the community without a well-organized system for sustainability. Weak rules were proved to affect the sustainability of exclosures in Tigray [13]. Under this category is also the protection of economically important plant species like *Boswellia Papyrifera* [43]. Maintaining key management features such as guarding until conservation and establishment objectives are attained, would help sustainability. Identification of community problems and community-driven solutions can enhance the ecological and socioeconomic contribution of exclosures.

Thirdly, some exclosure areas were established to buffer some adverse effects on different community resources. Administrative restructuring of villages to suit development interventions and governance resulted in ownership problems of commonly used grazing areas and the village that claims ownership decided to protect them by changing into exclosures and assigning guards. Moreover, when a grazing area of a village is adjacent to another village it decides to buffer its grazing land by establishing an exclosure bufferzone of a few kilometres. These types of exclosures are community-driven and are emerging opportunities for sustainable exclosure development. However, the goal must be in line with the economic and ecological development plans of the village that owns the forest area, and the systems must be such that conflicts typical of forest programs do not arise. Communities may aim to designate certain areas as buffer zones; however, these areas often evolve into natural forests that connect with other designated exclosures, thereby improving forest management initiatives. A study conducted by [44] corroborated these observations.

Other community motivations for establishing exclosures including protection from the effects of flooding on farmlands along riverbanks, settlements, churches, and sacred cemeteries, are relatively sustainable. When local community objectives for establishing exclosures are to protect farmlands from prevailing torrential rains, Drbal et al. [45] suggest identification of critical points to curtail the risks of flood hazards is useful. Physical structures reduce runoff and allow nutrients to be absorbed by protected soils, improving vegetation on degraded fields and further boosting agricultural protection [46]. In practice, integrated landscape management protects lands

downstream that may be settled or used for farming. However, as plans are not created in conjunction with stakeholders, localities lack the capacity to design comprehensive and integrated solutions that cover the economic, social, and protection spheres. This calls for the establishment of grassroots institutions that should be periodically equipped with financial, physical, and human resources.

A small proportion of exclosures was established for private fattening PLCs and Research works on agriculture and natural resources development. These establishments have little support from the general public, are frequently targets of theft and illegal grazing, and are only safeguarded by tight guarding procedures. In theory, such investments could garner public support through job creation, free community services, and technology demonstrations. Investment is a good starting point to increase private sector participation that is currently very limited, but urgently needed to scale-up and accelerate landscape restoration [47]. When fully involved, the private sector will function effectively, as evidenced by the success of tree planting in China [48]. Designated research areas can be helpful to identify limitations to successful degraded land restoration and measure restoration success, assess the impact of disturbance management, trends and suggest future research directions [49]. However, grassroots participatory planning is useful but lacking [13].

4.3. Pre-exclosure land use

Most of the exclosures (96%) were established on communal grazing lands, which significantly reduced their size. This report is in agreement with Mekuria [1] and Napier and Desta [50]. The shrinkage of communal grazing lands [51] promoted overexploitation [52] exposing it to degradation. This implies that the recruitment of exclosures is done according to the geographical location of the grassland without focusing on the suitability of the land for economic and ecological development. Under the 4-returns, 3-zones and 20 years approach [47], a natural zone with forest and nature restoration; a combined zone with mixed agriculture and nature; and an economic zone with sustainable production need to be identified. In the current study, the combined and economic zones are missing which challenges its sustainability. The tangible benefits of exclosures to household income in the study area were found to be meager [53]. Therefore, the economic and ecological suitability requires re-evaluation.

4.4. Level of Degradation, Duration of SWC and Plantation of exclosures during establishment

Although the establishment process did not take into account the degree of degradation analysis and therefore, no specific recommendations were made, our discussion revealed that 63% were very severely degraded at the time of inception (Figure 2 (b)). To help understand the soil ecosystem during forestation, respondents were asked to list degraded lands under the severely degraded categories if it was highly dominated by gullies and landslips. Indeed, 75% of the areas selected for reforestation were severely and very severely degraded at the time of inception. Therefore, most forests are intrinsically justified in terms of protecting soil from erosion. The level of degradation at the time of establishment has a direct effect on the duration of restoration [54]. The planning, implementation and assessment of restoration of degraded land had to be based on recommendations, which in turn depended on the severity of the degradation. However, the quota system did not come up with specific recommendations for restoration as it did not even properly categorize the areas depending on the severity of degradation. However, landscape restoration cannot follow a one-size-fits-all solution, but depends on complex socio-ecological systems that bring challenges and opportunities that can best be answered through a framework program for planning, designing, directing and monitoring systemic reforestation projects [55]. One such foundation documents basic information about the severity of degradation [56] and the overall suitability of the land for environmental and economic development. Severe degradation for example, extends the payback period of restoration [56]. In this study, soil and water conservation (SWC) structures at closed sites took an average of 2.58 years to complete, and in some cases the maximum time was 8 years. Similarly, exclosure plantations are conducted annually for 5.58 years and the maximum length is 28 years. The good news is that a comprehensive approach to restoring degraded lands and maintaining their ecological and socio-economic sustainability is possible by conducting a preliminary analysis of land suitability for economic and ecological development. Scientific evidence shows that degraded rangelands lose resilience through loss of resistance rather than loss of recovery potential [57].

4.5. Command Area, Cooperation and Conflicts

Our assessment of the results, where 79 of the exclosures flow into farmland, nine into rivers, and 20 have no command area, indicates that little consideration has been given to the suitability of the land for economic and ecological development (Table 3). In addition, some have less potential to either improve groundwater renewal or lack a well-thought-out water use strategy. As a result, of the exclosures with command areas, 52 sites are used as rain-fed cultivation areas, where scanty irrigation is tried, for example, fruit trees and vegetables are grown. The availability of command areas is linked to an economic development zone through crop and animal farming [47]. As a direct effect of exclosure, especially if a new source of water is created due to groundwater recharge, exclosures can be considered very suitable for strong economic and ecological development.

Exclosures linked with other regions, districts and villages are 5, 16 and 54 sites respectively. We asked if linked administrative units cooperate to construct SWC structures and protect exclosures from any illegal acts. Unfortunately, only 5 sites have contributions from linking administrative units in developing exclosures. Moreover, there are sites whose success only benefits mainly another adjacent village. In such cases, conflicts were observed.

5. Conclusions

Even if the motive of the regional administration was to conserve, communities have taken some steps and attempted to establish exclosures based on different common interests (buffer, grass, church protection, secure ownership, occasional grazing during worse conditions, water development, etc). This gives a hint that decentralization and community empowerment can lead to objective-based exclosure establishment. Moreover, communities have different problems, desires and expectations from delineating a particular area as an exclosure and thus blanket recommendation of conservation cannot work as a blueprint for all villages and districts. Local community demand-based exclosure establishments are likely to be sustainable as defined objectives can be met by the specific exclosures recruited. We conclude that a pre-establishment assessment was not properly conducted which is critical for successful exclosure development and decision on type of exclosures, their management and objective evaluation of progress. Based on well-established appropriate criteria, exclosure must be introduced as an ecological restoration and economic development strategy. It is essential to research the economic benefits that communally used grazing lands already provide to nearby people and to create exclosures that may effectively provide those benefits. This may encourage farmers to sign up for the program and voluntarily seek out other degraded communal lands that would require more time to provide economic and ecological benefits

We recommend a detailed characterization of future recruitment of degraded land for restoration programs, considering that the land is suitable for the local population's sustainable ecological and socioeconomic development. Community members should discuss each newly selected area for enrollment to exclosures and detailed records should be kept for monitoring and evaluation. To do these strong institutional arrangements at the village level is crucial. Clear guidelines on planning, implementation and evaluation of exclosures are required. In the case of regions, districts and villages are found to be connected by exclosures, participatory planning, implementation and evaluations are important.

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