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Review Article

Potential Tree/Shrubs Species for Restoring Degraded Land in Ethiopia

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Abstract

The depletion of natural resources is a major problem facing human beings. Land degradation, especially in developing countries, has been identified as the most serious environmental problem. Ethiopia is gifted with abundant natural resources however; those resources are not properly identified, well-managed, and fully exploited. Land resources are the backbone for developing countries to produce different agricultural outputs because the economic gain of developing countries is dependent on agriculture. However, due to land degradation, the potential of land providing the maximum output has declined. The concern of this article review is collating and organizing knowledge on the positive response of plating tree species on degraded ecosystems. This review synthesizes findings from 55 studies. The outcome of this review confirmed that planting of potential tree/ shrub species is highly recognized in restoring degraded land. Thus, restoration of degraded lands can be achieved through using tree/shrub covers and establishing area closures. In restoring degraded areas planting site-specific and best-performed plant species is the best solution. Tree planting improves soil chemical properties, such as organic matter content, cation exchange capacity, and nutrient levels, while mitigating erosion and regulating the microclimate. The analysis affirms that afforestation and reforestation are vital to Ethiopia's strategy for sustainable rural livelihoods, ecological recovery, and economic resilience.

Keywords

Ecosystem Restoration, Land Degradation, Soil Quality Improvement, Tree Planting, Potential Tree Species

1. Introduction

Productivity and ecosystem service of the land resources are being seriously eroded by overutilization and unsustainable land management practices [1, 2]. People have been deteriorating land through unsustainable interference and improper management to get immediate returns [3, 4]. Land degradation is a natural and human-induced process in which the biological, economic and quality of land is reduced to perform essential functions and services [5]. As stated by Palm and his friend [6], degraded land is characterized by fragmentation of vegetation cover and diversity, nutrient-deficient soils, enhanced greenhouse gas emission and poor water infiltration and storage capacity.

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Even though land degradation has become a serious problem affecting all spheres of the social, economic and political life of the population in the world, its severity is highest in Sub-Saharan African countries [5]. Agricultural productivity and food security faced extremely undesirable challenges due to land degradation in sub-Saharan countries [7]. As estimated by the World Meteorological Organization, 2005, annually 0.5-1 percent losses productivity of cropping land in sub-Saharan Africa. Thus, it has been one of the biggest problems suffering the lives of 3.2 billion people of inhabitants, especially those residing in rural areas [8, 9]. Ethiopia is one of the countries in Sub-Saharan Africa that is well-gifted in terms of natural resources however, those resources are highly threatened by land degradation [10-12]. Due to high rate of land degradation people in Ethiopia are faced with serious problems in all scopes of the social, economic and political life of the population [13]. Especially rapid population growth in Ethiopia significantly increases degradation, expansions of agriculture and exploitation of land resources. As a result of this, agricultural productivity and food security showed a dramatic decline and reached a level beyond the subsistence requirement of households [14]. The report of [15] confirmed that the north and north-western regions of Ethiopia are severely attacked by land degradation and this is due to the area's steep slopes and are subject to serious soil erosion.

Responding to the root causes of declining crop and livestock productivity, natural resource degradation, high population growth and climate vulnerability is a crucial challenge facing Ethiopia today [15]. A possible solution for opposing the degradation of a land ecosystem is planting quality and site-matched tree species is provide positive responses for the restoration of degraded ecosystems [16]. To avert land degradation the government of Ethiopia has designed restoration activities and plans to restore 15 million hectares of its degraded land by 2025 [17]. Restoring degraded lands can be an effective solution for enhancing sustainable rural livelihoods, economic development, conservation of biodiversity, and resolving conflicts over resources [18, 19]. In a country like Ethiopia in which land resources are highly exposed to degradation, restoration activities are not an option [13]. The contribution of planting tree species through afforestation and reforestation programs is significantly higher in rehabilitating degraded lands of the country [20, 21]. Planting trees plays a central role in reducing erosion, adding organic matter to the soil, enhancing biodiversity, increasing soil microfauna, and enhancing the nutrient cycle [22]. Therefore, restoring degraded lands through tree planting is pointed out as a crucial step to return the productive potential of land, and its related benefit to meet their economic, social and environmental potentials.

2. Review Methodology

The methodological approach used in this review was a literature search and synthesis of relevant peer-reviewed articles and related literature. The review used an online search of different published and local sources of documents that relate to the topic using searching phrases of cause and consequence of land degradation and positive response of tree species in Ethiopia. Papers were searched on Google Scholar, Research4life, Scopus/Elsevier, Research Gate, EMBASE, and PubMed using severe keywords. As a result, a total of 682 published articles were searched from these, 55 articles were selected that met the review's criteria (Figure 1). The selected articles seek to cover articles with titles that exactly match.

3. Results and Discussions

For this review, we have used 55 article papers from the total searched 682 research articles. We have used key words related to importance of tree/shrubs planting in restoring land degradation in Ethiopia in searching articles from different sources. Research articles on the importance of tree/shrubs planting for the restoration of degraded lands in Ethiopia considerably between 2006 and 2022 (Figure 2).

We have used 187 articles for bibliographic reference of keyword co-occurrences (Figure 3) and author co-occurrences (Figure 4). Keyword co-occurrences of land degradation and tree response in Ethiopia research from 2006-2022 (The nodes denote the frequency of documents in which the keyword was mentioned. The node colors represent the cluster in which the keyword belongs

Similar with key word co-occurrence we have used 187 articles for looking co -authorship network. Co-authorship network over time (year of publication) and co-authorship network by Author name. (The node colors represent the year that the document was published) (Figure 4).

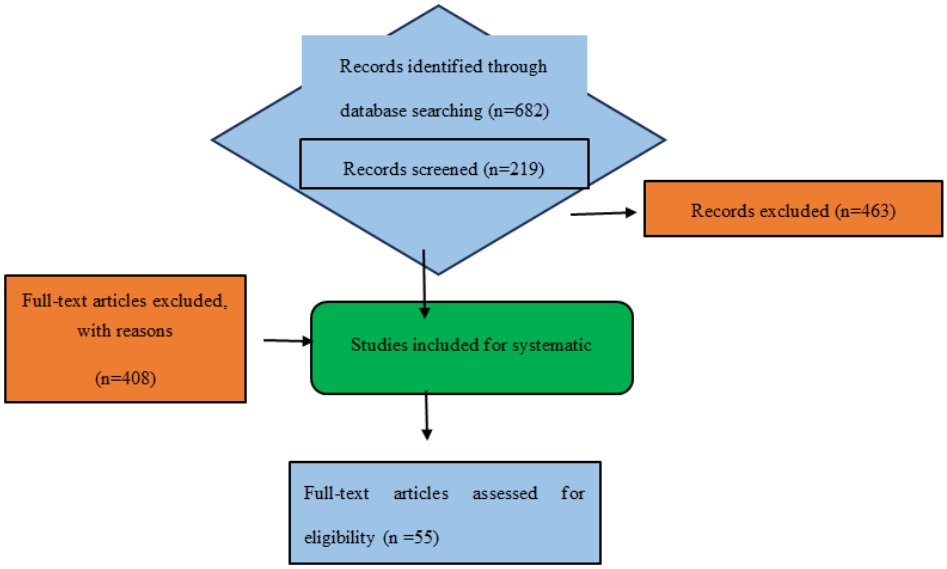

Figure 1. *Flow chart of the review article selection process.*

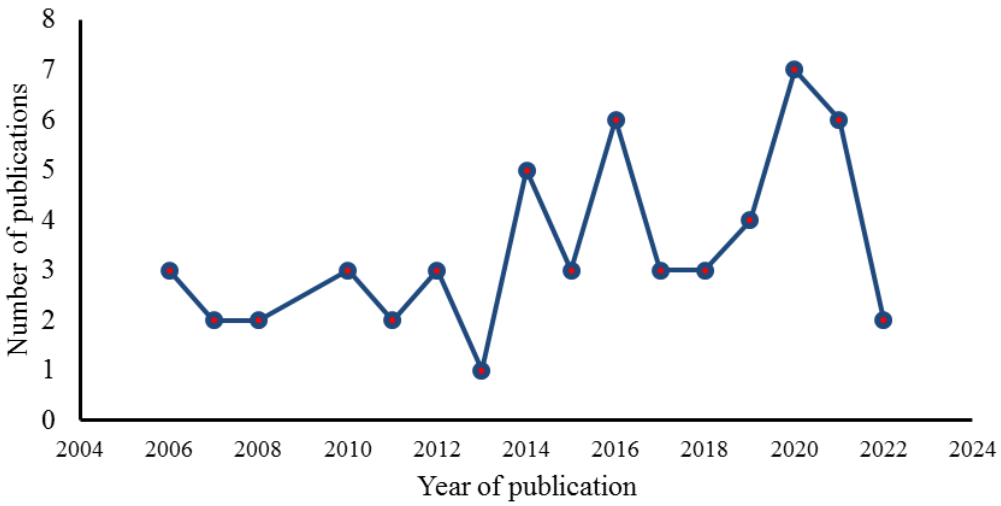

Figure 2. *Number of articles published from 2010 to 2021.*

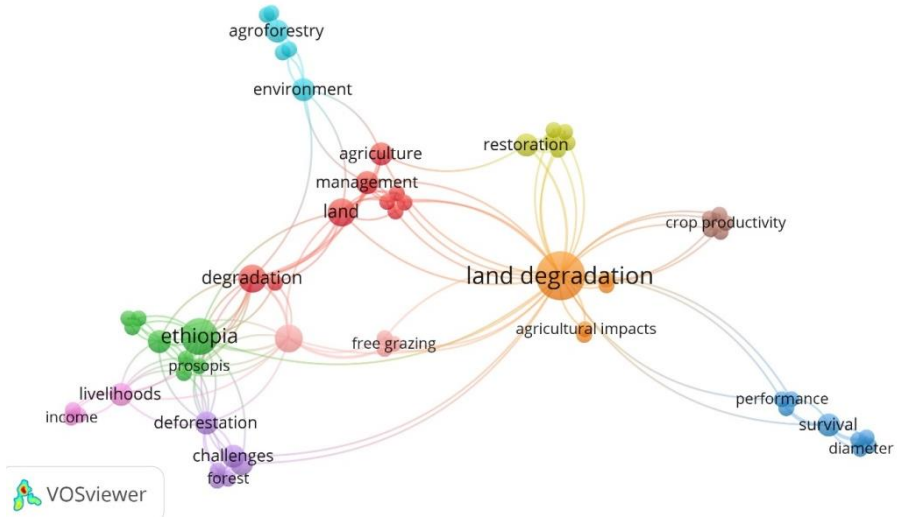

Figure 3. *Key word co-occurrence (Prepared by the authors based on research results).*

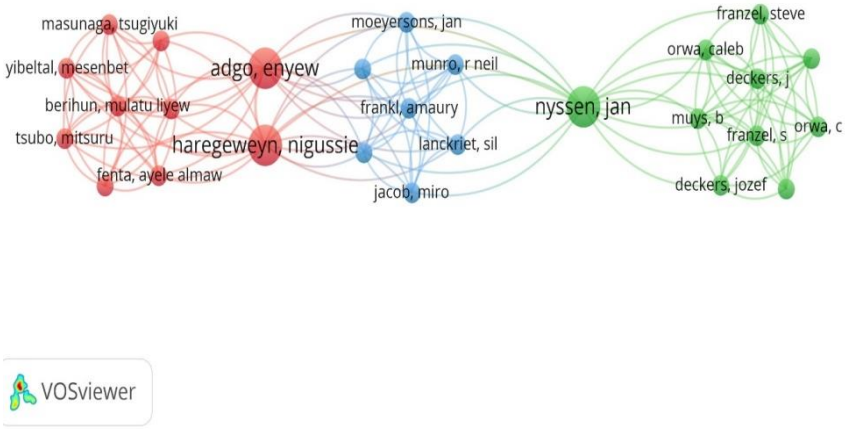

Figure 4. *Author co-occurrence (Prepared by the authors based on research results).*

3.1. Role of Tree/Shrubs on Restore Degraded Areas

To address land degradation, the Ethiopian government has implemented restoration initiatives with a goal of rehabilitating 15 million hectares of degraded land by 2025 [17]. Among the strategies receiving significant attention are reforestation and afforestation approaches, which are considered effective for ecological restoration. These methods have been identified as key solutions for restoring tropical degraded lands and their biodiversity, including those in Ethiopia [31, 32]. Restoring degraded lands is essential for promoting sustainable rural livelihoods, fostering economic development, conserving biodiversity, and resolving resource-related conflicts [18].

Restoration involves facilitating the recovery of ecosystems that have been degraded, damaged, or destroyed [25]. It is a core activity undertaken to rehabilitate degraded lands in Ethiopia [25]. Consequently, afforestation has been emphasized as a critical step to rejuvenate the productive capacity of degraded land. This process is pivotal in unlocking the land's economic, social, and environmental potential, ensuring long-term benefits for communities and ecosystems alike.

The planting and establishment of trees on degraded land should be the first important step in soil rehabilitation and land reclamation [26]. In restoring degraded ecosystems, the contribution of forestry is significantly higher. Degraded lands are restored through forest interventions, afforestation techniques and agroforestry models. Thus, degraded lands are further restored through biomass accumulation, floristic compositions, land nutrient distribution, rehabilitation and management implications. Tree plantation on degraded land has been a widely promoted method of restoring degraded lands [27]. Planting of tree species in degraded ecosystems plays a vital role in overcoming land degradation through soil stabilization, nutrient cycling, microclimate regulation, enhancing water retention and enhancing biodiversity [27, 44, 46, 50-54].

Restoring degraded lands can be an effective solution for improving vegetation composition, sequestering carbon in vegetation and soil, and improving hydrological cycles and micro-climate [27-31]. Even though the establishment of plant species in degraded areas remains a long-lasting challenge, they have a positive response to the sustainable restoration of degraded lands. The potential productivity of degraded lands can be achieved through tree plantation (single tree species planting or mixed tree species planting) and area closures [32-34]. Ethiopia has a habit of planting a seedling in different land use types including degraded lands to meet the plan settled for 2025 [35]. Even though a high amount of tree seedlings were planted each year, the survival rate and the performance of seedlings to adopt the planting site is minimal. Deciding the type of species to be planted on any degraded land requires a well-conducted field trial to match a species to a particular site. As reported by different scholars the survival rate and the growth performance of seedlings were minimal, due to poor species-site matching [34].

3.1.1. Potential Trees/Shrubs for Restoration of Degraded Ecosystem

Restoring land degradation through reforestation and afforestation requires appropriate tree/shrub species that are well-suited to the specific environmental conditions of the degraded area [5]. Selection of the best and appropriate tree species is a valuable tool for the ecological restoration of degraded lands. Tree species for restoring degraded lands are characterized by resilience to the local climate conditions and are beneficial to the ecosystem [4, 36].

Research scholars reported that *Acacia* species, *Croton macrostachyus, Azadirachta indica, Cordia africana* and *Millettia ferruginea* have fast growth performance and are culturally accepted and widely used for restoring degraded lands in Ethiopia [4, 36]. The planting of *Acacia* species is extremely high in restoring degraded lands and highly practised by different organizations in different locations of the

country. This is due to *Acacia* species having high in tolerating environmental stresses like water shortage and poor soil conditions in degraded areas. In addition, Acacia species improve soil quality and facilitate the quick increment of the population of other plant species that provide income plus protection of the area [37]. Summarized studies on tree species having a high survival rate (%) and high growth rate in degraded ecosystems in Ethiopia are presented in Table 1.

Table 1. *Summarized studies on tree species having a high survival rate (%) in degraded ecosystems in Ethiopia.*

No.	Scientific name	Family	Local name	Origin	Growth habit	Geographical Location	Source
1.	*Sesbania sesban*	Fabaceae	Shewshewe	Indigenous	Tree/Shrub	West Showa Zone of Oromiya Regional State, Central Highlands of Ethiopia; Harari Region, Ethiopia; Dugda Dawa District, Southern Ethiopia; Babille District, Ethiopia	[4, 38-40]
2.	*Eucalyptus camaldulensis*	Myrtaceae	Key Bahir Zaf	Exotic	Tree	West Showa Zone of Oromiya Regional State, Central Highlands of Ethiopia; Central Zone of Tigray, Ethiopia; Tanqua Abergelle and Weri-Leke Weredas, Tigray, Ethiopia; Semi-Arid Region of Northern Ethiopia	[4, 41-43]
3.	*Acacia saligna*	Fabaceae	Girar	Exotic	Tree	West Showa Zone of Oromiya Regional State, Central Highlands of Ethiopia; Degraded Lands in Wag-Lasta Area, Northeastern, Central Zone of Tigray, Ethiopia; East Shoa Zone Ethiopia; Semi-Arid Region of Northern Ethiopia	[4, 5, 43, 44]
4.	*Juniperus procera*	Cupressaceae	Yehabesha Tsid	Exotic	Tree	Liban District, Central Highland of Ethiopia	[45]
5.	*Moringa oliefera*	Moringaceae	*Moringa*	Exotic	tree	Harari Region, Ethiopia; Babille District, Ethiopia	[38, 39]
6.	*Azadarichta indica*	Meliaceae	Neem	Exotic	Tree	Harari Region, Ethiopia; Babille District, Ethiopia	[38, 39]
7.	*Leuceana leucocephala*	Fabaceae	Leucaena	Exotic	Shrub	Harari Region, Ethiopia; Babille District, Ethiopia	[38, 39]
8.	*Cordia Africana*	Boraginaceae	Wanza	Indigenous	Tree/Shrub	Degraded Lands in Wag-Lasta Area, Northeastern Ethiopia; Central Zone of Tigray, Ethiopia; Liban District, Central Highland of Ethiopia	[5, 41, 45]
9.	*Jatropha curcas*	Euphorbiaceae	*Jatropha*	Indigenous	Shrub	Degraded Lands in Wag-Lasta Area, Northeastern Ethiopia	[5]
10.	*Melia azedarach*	Meliaceae	Chinaberry	Exotic	Tree	Degraded Lands in Wag-Lasta Area, Northeastern Ethiopia; Dugda Dawa District, Southern Ethiopia; East Shoa Zone Ethiopia; Hawi Gudina District, West Hararghe Zone, Ethiopia; Babille District, Ethiopia	[5, 39, 40, 46]
11.	*Gravilea robusta*	Proteaceae	*Grevillea*	Indigenous	Tree	Harari Region, Ethiopia; Ethio-	[38, 42,

No.	Scientific name	Family	Local name	Origin	Growth habit	Geographical Location	Source
						pian Central Highlands; Tanqua Abergelle and Weri-Leke Weredas, Tigray, Ethiopia	47]
12.	*Pennisetum polystachion*	Poaceae	Panicum	Indigenous	Grass	Central Zone of Tigray, Ethiopia	[42]
13.	*Faidherbia albida*	Fabaceae	Gerbi	Indigenous	Tree	Central Zone of Tigray, Ethiopia, Dugda Dawa District, Southern Ethiopia, East Shoa Zone Ethiopia	[38, 42, 48]
14.	*Olea europaea*	Oleaceae	Weira	Indigenous	Tree	Central Zone of Tigray, Ethiopia; Oromiya Regional State, Central Highlands of Ethiopia	[42, 45]
15.	*Acacia abyssinica*	Fabaceae	Bazera Gerar	Indigenous	Tree	Central Zone of Tigray, Ethiopia	[42]
16.	*Dodonea angustifolia*	Sapindaceae	Kitkkita	Indigenous	Shrub	Dugda Dawa District, Southern Ethiopia	[40]
17.	*Cupressus lusitanica*	Cupressaceae	Tisd	Exotic	Tree	Central Highlands of Ethiopia	[42]
18.	*Eragrostis capitulifera.*	Poaceae	Marga	Indigenous	Grass	Dugda Dawa District, Southern Ethiopia	[40]
19.	*Hagenea abyssinica*	Rosaceae	Kosso	Indigenous	Tree	Ethiopian Central Highlands; Lake Haramaya Watershed, Eastern Ethiopia; Oromiya National Regional State, Southeastern Ethiopia	[42, 49, 50]
20.	*Acacia senegal*	Fabaceae	Sebansa Girar	Indigenous	Tree	Wag-Lasta Area, Northeastern Ethiopia	[5]
21.	*Moringa stenopetala*	Moringaceae	Shferaw	Indigenous	Tree	Wag-Lasta Area, Northeastern Ethiopia; Tanqua Abergelle and Weri-Leke Weredas, Tigray, Ethiopia; Dugda Dawa District, Southern Ethiopia	[5, 40, 42]
22.	*Olea africana*	Oleaceae	Olea	Indigenous	Tree	Lake Haramaya Watershed, Eastern Ethiopia	[49]

3.1.2. Tree/Shrub Species Having a High Growth Rate (%) in a Degraded Ecosystem

Tree species with high growth rates are vital for restoring degraded ecosystems in Ethiopia, where rapid land rehabilitation is critical. One notable species is *Eucalyptus* species, widely used for its adaptability to various soil types and harsh conditions [38-43]. This fast-growing species thrives in degraded landscapes, providing quick canopy cover that reduces soil erosion and enhances moisture retention. Despite concerns about its high-water consumption, proper site selection and management can mitigate these impacts while maximizing its benefits for fuelwood and construction materials [41-43]. Similarly, *Acacia decurrens*, another fast-growing species, is highly valued for its ability to fix nitrogen, improving soil fertility and supporting the growth of other vegetation in nutrient-poor soils [5, 42].

Another group of high-growth species includes *Sesbania sesban* and *Leucaena leucocephala*, both of which are nitrogen-fixing legumes [4, 38, 51]. These trees are particularly effective in regenerating degraded ecosystems due to their ability to improve soil fertility within a short period. They also produce abundant biomass that can be used as green manure or fodder, providing both ecological and economic benefits to local communities [38, 51]. The integration of these fast-growing species into restoration programs in Ethiopia can significantly accelerate ecosystem recovery while supporting sustainable livelihoods through diversified resources. Sum-

marized studies on tree species having a high growth rate (%) in a degraded ecosystem in Ethiopia is presented in Table 2.

Table 2. Summarized studies on tree species having a high growth rate (%) in a degraded ecosystem in Ethiopia.

No.	Scientific name	Family	Local name	Origin	Growth habit	Geographical Location	Source
1.	*Eucalyptus globulus*	Myrtaceae	Nech Bahir Zaf	Exotic	Tree	Ethiopian Central Highlands; Semi-Arid Region of Northern Ethiopia	[42, 43]
2.	*Acacia decurrens*	Fabaceae	Girar	Exotic	Tree	Ethiopian Central Highlands; Wag-Lasta Area, Northeastern Ethiopia	[5, 42]
3.	*Luecaena pallida*	Fabaceae	*Luecaena*	*Exotic*	*Shrub*	Wag-Lasta Area, Northeastern Ethiopia	[5]
4.	*Acacia Senegal*	Fabaceae	Sebansa Girar	Indigenous	Tree	Wag-Lasta Area, Northeastern Ethiopia; Ethiopian Central Highlands	[5, 40]
5.	*Sesbania sesban*	Fabaceae	Shewshewe	Indigenous	Shrub/tree	Harari Region, Ethiopia; Central Zone of Tigray, Ethiopia; Oromiya Regional State, Central Highlands of Ethiopia	[4, 38, 51]
6.	*Azadarichta indica*	Meliaceae	Neem	Exotic	Tree	Harari Region, Ethiopia	[38]
7.	*Leuceana leucocephala*	Fabaceae	*Leuceana*	*Exotic*	*Shrub*	Harari Region, Ethiopia	[38]
8.	*Acacia saligna*	Fabaceae	Girar	Exotic	Tree	Central Zone of Tigray, Ethiopia; Oromiya Regional State, Central Highlands of Ethiopia	[4, 51]
9.	*Eucalyptus camaldulensis*	Myrtaceae	Key Bahir Zaf	Exotic	Tree	Oromiya Regional State, Central Highlands of Ethiopia; Tanqua Abergelle and Weri-Leke Weredas, Tigray, Ethiopia	[4, 38, 42]
10.	*Azadarichta indica*	Meliaceae	Neem	Exotic	Tree	Harari Region, Ethiopia	[38]
11.	*Hagenea abyssinica*	Rosaceae	Kosso	Indigenous	Tree	Lake Haramaya Watershed, Eastern Ethiopia	[49]

3.1.3. Potential Tree/Shrub Species for Enhancing Soil Quality on Degraded Land

Tree species that have a high potential to enhance soil quality parameters depend on the nature of the species, the quality of the site and the climate conditions of the degraded ecosystem. However, there are commonly used trees like *Sesbania sesban, Acacia saligna (Labill.), Azadarichta indica, Acacia Senegal, Dombeya torrida (J.F. Gmel.), Hagenia abyssinica (Bruce) J.F. Gmel, Juniperus procera, Acacia decurrens, Dalbergia melanoxylon, Oxytennathera abyssinica, Millettia ferruginea, Faidherbia abida,* and *Croton macrostachyus* having best potential in restoring degraded land by enhancing soil quality parameters (soil organic matter, cation exchange capacity, total Nitrogen, available Phosphorus, soil pH) [4, 38, 55]. Summarized studies on the best tree species used for enhancing soil quality in the degraded land of Ethiopia are presented in Table 3.

Table 3. Summarized studies on best tree species used for enhancing soil quality in degraded land of Ethiopia.

No.	Scientific name	Family	Local name	Origin	Growth habit	Geographical Location	Source
1.	*Sesbania sesban*	Fabaceae	Shewshewe	Indigenous	Tree/Shrub	West Showa zone of Oromiya Regional State, Central Highlands of Ethiopia; Harari Region, Ethiopia; Dugda Dawa District, Southern Ethiopia	[4, 38, 40, 51]
2.	*Acacia saligna (Labill.)*	Fabaceae	Girar	Exotic	Tree/Shrub	West Showa zone of Oromiya Regional State, Central Highlands of Ethiopia; Harari Region, Ethiopia; Dugda Dawa District, Southern Ethiopia	[4, 38, 40, 51]
3.	*Azadarichta indica*	Meliaceae	Neem	Exotic	Tree	Harari Region, Ethiopia; Babille District, Ethiopia.	[38, 39]
4.	*Acacia Senegal*	Fabaceae	Girar	Exotic	Tree	Harari Region, Ethiopia	[38]
5.	*Dombeya torrida*	Sterculiaceae	Wulkfa	Indigenous	Tree	Galessa and Jeldu areas, Western Shewa, Ethiopia	[61]
6.	*Hagenia abyssinica*	Rosaceae	Kosso	Indigenous	Tree	Abichu Gnea Woreda, North Shoa Zone, Oromia Regional State, Ethiopia; highlands of Central Ethiopia	[50, 51, 61]
7.	*Juniperus procera*	Cupressaceae	Yehabesha Tsid	Exotic	Tree	Galessa and Jeldu areas, Western Shewa, Ethiopia	[61]
8.	*Acacia decurrens*	Fabaceae	Girar	Exotic	Tree	Guder watershed, North Western highlands of Ethiopia	[62]
9.	*Dalbergia melanoxylon*	Fabaceae	Zobbi	Endemic	Tree	Central Rift Valley of Ethiopia; Wacho watershed. Southern Ethiopia, Central Rift Valley of Ethiopia, southern Ethiopia	[43, 63]
10.	*Oxytennathera abyssinica*	Poaceae	Qerkeha	Indigenous	Shrub	Wacho watershed. Southern Ethiopia; semi-arid Ethiopia	[43, 63]
11.	*Millettia ferruginea*	Fabaceae	Birbira	Endemic	Tree	Southern Ethiopia; Sidama, Southern Ethiopia; Northern Ethiopia	[64, 46]
12.	*Faidherbia abida,*	Fabaceae	Gerbi	Indigenous	Tree	Wacho watershed. Southern Ethiopia	[63]
13.	*Croton macrostachyus*	Euphorbiaceae	Bisana	Indigenous	Tree	Wacho watershed. Southern Ethiopia	[63]

3.2. Effect of Tree Planting on Degraded Land in Enhancing Soil Quality

Tree planting is a powerful tool for enhancing soil quality on degraded lands, addressing issues such as nutrient depletion, erosion, and poor structure [44]. Tree roots stabilize the soil, reducing erosion by anchoring soil particles and mitigating surface runoff [52-54]. Additionally, trees improve soil structure by promoting aggregation, which enhances water infiltration and reduces compaction. The canopy cover provided by trees minimizes the direct impact of rainfall on the soil surface, further preventing erosion and maintaining moisture levels. These improvements in soil's physical properties create a more favorable environment for plant growth and ecosystem recovery [4, 55-60].

The impact of tree planting extends to the chemical and biological aspects of soil health. Decomposing leaf litter and

organic residues from trees enrich the soil with organic matter, enhancing nutrient availability. Nitrogen-fixing species, such as *Acacia* or *Leucaena*, play a particularly important role by replenishing nitrogen levels in the soil, which are often depleted in degraded lands. Moreover, tree roots and organic matter promote microbial activity and diversity, which are critical for nutrient cycling and soil fertility [59, 60]. By restoring these soil qualities, tree planting not only rehabilitates degraded ecosystems but also supports agricultural productivity and sustainable land use [55-60]. Different tree species that have good potential to enhance soil quality before and after tree plantation intervention are presented in Table 4.

Table 4. *Summarized studies on improvement of Soil Chemical properties due to tree planting intervention on degraded land in Ethiopia.*

No.		Soil quality parameters					Geographical Location	Source
		Soil Organic Matter (%)	Cation Exchange Capacity (meq/100g dry soil)	Total Nitrogen (%)	Available Phosphorus (mg kg^{-1} dry soil)	Soil pH (1: 2.5 water)		
1.	Initial	1.25±0.25	21.87±3.52	0.047±0.01	0.88±0.15	8.06±0.13	West Showa zone of Oromiya Regional State, Central Highlands of Ethiopia,	[4]
	After intervention	1.49±0.62	19.74±4.1	0.063±0.32	0.95±0.14	7.74±0.27		
2.	Initial	1.47 ± 0.40	9.58±1.406	0.025	0.07 ± 0.02	7.26±0.508	Shashogo Woreda, Southern Ethiopia	[55]
	After intervention	2.76 ± 0.37	18.76 ±3.1	0.048	0.14± 0.018	6.98±0.156		
3.	Initial	1.85±0.37	26.92±2.17	0.19±0.03	4.84±0.81	5.34±0.08	Analemo Woreda, Southern Ethiopia	[56]
	After intervention	2.33±0.44	28.82±2.99	0.20±0.03	6.12±0.78	5.63±0.26		
4.	Initial	1.85±0.37	26.92±2.17	0.19±0.03	4.84±0.81	5.34±0.08	Guder subWatershed, Southern Ethiopia	[57]
	After intervention	2.33±0.44	28.82±2.99	0.20±0.03	6.12±0.78	5.63±0.26		
5	Initial	1.29±0.06	30.41±1.39b	0.11±0.01	4.52±0.32	6.82±0.04	Lowland conditions of Ethiopia	[58]
	After intervention	1.89±0.11	35.53±1.06	0.16±0.02	5.18±0.25	6.74±0.03		
6.	Initial	3.02±0.12	44.44±0.67	0.35±0.02	1.24±0.10	7.11±0.03	North Shewa Zone, Amhara Region, Ethiopia	[59]
	After intervention	1.55±0.12	38.18±0.8	0.14±0.01	0.57±0.06	7.46±0.04		
7.	Initial	2.0 ± 0.3		0.2 ± 0.0	12.9 ± 5.8	5.7 ± 0.6	Blue Nile Basin, Ethiopia	[60]
	After intervention	3.9 ± 1.0		0.3 ± 0.0	13.2 ± 4.6	5.5 ± 0.6		

4. Conclusion

Land degradation is a decline or total loss of the productive capacity of the land for present and future uses. Even though the occurrence of land degradation is slow, it has long-lasting impacts on rural people who become highly vulnerable. Shreds of evidence confirmed that this factor has been one of the biggest problems threatening the lives of millions of inhabitants in Sub-Saharan Africa, especially those residing in rural areas. Research scholars reported that agrarian communities are severely harmed by land degradation due to their livelihood depends on land.

In areas in which land degradation is severe, planting tree species has a positive impact on protecting the land from degradation and restoring previously degraded areas. However, not all tree species have a good capacity to grow and survive on degraded lands so we should have to select the best tree species that have good potential in growing on de-

graded lands. Selecting site-specific and site-match tree species is obligatory. On the other way, applying plantation intervention enhances the vegetation recovery of the degraded ecosystem. Planting tree species in the degraded area has a significant role in reducing the serious soil erosion and land degradation that has been taking place due to cultivation on steep slopes and clearing vegetation in day-to-day human activities. So that soil's physical and chemical properties are increased. Overall planting site-specific plant species is the only best solution to protect the land from degradation and to restore lands that are previously degraded.

Abbreviations

EMBASE	Excerpta Medica dataBASE
Kg^{-1}	Per Kilogram
Meq/1000g	Milliequivalents per 100 Grams
pH	Potential of Hydrogen

Author Contributions

Conceptualization, Addisu wolde; methodology for article selection, Addisu Wolde and Sisay Desalegn; validation, Addisu Wolde, Zigijit Kassa and Sisay Desalegn; data analysis and synthesis, Addisu Wolde, Zigijit Kassa and Sisay Desalegn; writing—original draft preparation, Addisu Wolde; final write-up of the paper, Addisu Wolde and Sisay Desalegn. Authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

The data supporting this review are from previously reported studies and datasets, which have been cited.

Conflicts of Interest

The authors declare no conflicts of interest.

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