

# A Brief Review on Species Diversity, Regeneration and Conservation in Ethiopia

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## Abstract

Ethiopia is one of the world's countries with abundant biological resources. Natural vegetation is one of these resources. Forests provide livelihoods for millions of people in our country by providing a variety of products in many parts of the country. Forests and trees have a direct association with forest and trees. There are groups that live within or next to forested territory and derive their livelihood directly from the forest, particularly in underdeveloped nations like Ethiopia. Forests are essential for human survival, health, happiness, and enjoyment. Forests provide raw materials for both wooden and non-wooden items, as well as space for human settlements and cultivation. Excessive exploitation of natural forests in Ethiopia without minimal repair. Because there is a conservation and management issue that needs to be addressed in order to restore the currently exploited forest. Their diversity and area coverage, on the other hand, are rapidly dwindling. The greatest dangers to increased woody diversity loss are deforestation, agriculture, invasive species, and land degradation. Ethiopia, for example, has been severely impacted by these variables, resulting in desertification, poverty, and the loss of natural resources.

To address these issues, forestation and conservation measures have been implemented. As a result, sustainable forest management has been a major focus in our country in order to relieve and lessen forest pressure. Its goal is to ensure that all forest-derived applications fulfill current needs without jeopardizing future generations' ability to meet their own needs. The goal of sustainable forest management is to achieve a balance of social, economic, and environmental goals.

**Keywords:** Ethiopia; Threat; Diversity; Regeneration

## Introduction

### Background of Ethiopian forest

Ethiopia is a hilly country with a wide range of landscapes. River valleys and undulating plains were carved out by Rocky Mountains, flat-topped plateaus, and deep gorges. Because of its diverse physical features, the country has the richest forest cover in tropical Africa. Human existence and well-being are dependent on these woodlands. They are home to two-thirds of all terrestrial and woody animal and plant species. Over 5,000 economically traded products are sourced from them, ranging from medications to lumber and clothes. Forests provide livelihoods for millions of people throughout the world by providing a variety of products. Their diversity and area coverage, on the other hand, are rapidly dwindling. In many regions of the world, the loss of forest cover and biodiversity due to anthropogenic activity is becoming a major issue. Africa's forest cover is estimated to be 650 million hectares, making up 17% of the world's forests and home to several worldwide biodiversity hotspots. Afromontane vegetation, a type of vegetation found in Africa's highlands, covers more than half of the continent's area. Ethiopia is regarded as one of Africa's most important countries in terms of biological resources, including flora and fauna. Flora of Ethiopia and Eritrea Volumes 1-8 contain over 6000 species of higher plants (flowering plants, conifers, and ferns), with roughly 10% of them being indigenous to the country. Throughout history, humans have exploited the environment's resources, including plants, animals, and other natural resources, for financial advantage; however, many of these practices are now considered unsustainable. Forests evolve in a variety of ways. Deforestation or natural disasters such as volcanic eruptions can both limit its size. As a result, forest areas are shrinking around the world, partially due to logging activities and partly due to habitat conversion to croplands (agricultural expansion), which accounts for up to 40% of Ethiopian forest losses.

Deforestation is particularly severe and widespread in northern Ethiopia. Most of the mountainous sides are bare due to the absence of vegetation. Valleys have been gullied, striping has occurred, and streams that once had water all year are now mostly dry during the dry season. The size and distribution pattern of the human and domestic animal population, the level of resource use, market forces, and policies are all current contributory factors that have exacerbated the reduction of woody species diversity in Ethiopia. Furthermore, due to a lack of knowledge and a lack of attention to woody species conservation and sustainable use, understanding of woody species conservation in a narrow sense has been inadequate. Over the years, the country had seen significant deforestation, soil deterioration, and an increase in the amount of bare land. Forest degradation has been linked to the need for fuel wood, arable land, and grazing areas, which frequently result in the loss of forest cover and biodiversity, as well as erosion, desertification, and reduced water resources. The presence of individual mature trees amid farmlands, as well as pockets of forest near churchyards and religious burial places, suggest the presence of enormous swaths of forest previously. Previously, a large area of the Ethiopian highlands was thought to be covered by forests with a wider coverage than they do now, but these forests have gradually been removed, resulting in forest degradation due to unsustainable resource usage.

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Ethiopia, according to the Forest Resources Assessment (FRA), is one of the countries with forest cover ranging from 10 to 30 percent of total land area, with a forest cover of 12.4 million hectares. Sustainable forest management has been conducted through the application of conservation strategies to reduce the risk. Protecting forest areas with limited access for local residents has been proposed as a method of combating deforestation and its consequences. Advances in woody-biotechnology, in particular, have opened up new possibilities for woody-biodiversity multiplication and short- to long-term conservation employing in vitro culture techniques. Significant progress has been made in the conservation of endangered, uncommon, ornamental, and medicinal plants, as well as the entire woody species, particularly temperate and tropical vegetative propagated plants. The general objective of the review is to compile the threat of woody species diversity, regeneration status and conservation technique of forest in Ethiopia [1].

## Literature Review

### Vegetation type in Ethiopia

Ethiopian vegetation is intricately linked to the country's climate and geography. Highland uplift and rift formation caused by volcanic forces created novel ecosystems with varying terrain and climatic conditions, which have become drivers for vegetation diversification. Vegetation refers to the overall amount of plant life or cover in a specific region; it can also refer to the collection of plant species in that area. As a result, vegetation characterization refers to the identification and description of plants in terms of their distribution and location. An assemblage of plants growing together in a specific location is referred to as vegetation. It refers to an area's total vegetation cover. Ethiopia's climatic and geographical futures are various. Ethiopia has one of the greatest and most diverse plant genetic and wild animal resources in the world, thanks to extreme variations in climate, terrain, and other factors, as well as various ecological systems that are conducive to evolution.

Many variables influence vegetation formation, including climate, geology, edaphic factors, and biotic factors, as well as human interference in ecological succession. Vegetation is dynamic, in the sense that it is always changing. Ecological or evolutionary processes, climatic change, human land use, and interactions between factors could all be factors in the changes. Various authors have attempted to study Ethiopian forests and woody vegetation resources using various systems, with Tamrat (1993), Demel and Tamrat (1995), Friis and Sebsebe (2001), Kumilachew and Tamrat (2002), and Tadesse (2003) making significant contributions to understanding the country's vegetation and proposing conservation strategies. Recent studies provide a general description of vegetation types and floristic composition in various locations of Ethiopia. The numerous vegetation types of Ethiopia have been divided into distinct categories based on the writings of these and other authors. Ethiopia's biotic assemblage includes both afrotropical and Palearctic biota because to its relationship with the temperate biome in the north and the Arabian Peninsula during the dry glacial period. Based on height and climate gradients, Ethiopia has been divided into eight main plant types. Ethiopia is naturally diverse, with over 6500 species of vascular plants. Due to geographical isolation and distinct environmental circumstances, 12 percent of these species are endemic. However, researchers have yet to conduct comprehensive research into the ecology, phenology, evolutionary, genetic, and conservation status of Ethiopian forests at the community and species levels over time and space. The absence of research is preventing the objective of

zero worldwide plant extinctions from being met. Based on topography studies, there are four classification systems for Ethiopian vegetation types.

Ethiopian vegetation is divided into eight types based on elevation and climate (sebsebe et al). Afroalpine and subafroalpine vegetation, dry evergreen Afromontane forest and grassland complex, moist montane rainforest (including Afromontane rainforest and transitional rainforest) vegetation, Acacia-comiphora woodland vegetation, Combretum-Terminalia woodland & savannah vegetation, lowland semi-evergreen forest vegetation, Desert & semi-desert scrubland vegetation, and Aquatic vegetation [2].

### Concept of species diversity and forest regeneration in Ethiopia

The term "species diversity" refers to an assessment of biological diversity within a given ecological community. It denotes the species richness, or the number of species found in an ecological community, as well as the abundance, or the number of individuals per species, and the species distribution, or evenness. Species richness and species evenness are two aspects of species diversity. Species richness is a basic count of species, but species evenness measures how evenly the species' abundances are distributed. Animal species account for more than 70% of the total number of species documented, while plant species account for 22%. Species variety refers to the differences that exist within and across species populations, as well as between species. It can be quantified in terms of species richness, abundance, and heterogeneity of species. Ecologists can learn about community stability by studying species diversity, or at least species richness. The link between species diversity/richness and community stability is a complicated one. The ability of a system to rebound to an equilibrium state following a disruption, or simply the system's persistence, can be characterized as stability. The diversity-stability theory states that species differ in their attributes and that in a highly diversified (species rich) system, some species will be able to compensate for the loss of others following a disruption.

Forest regeneration refers to the process of establishing new seedlings after a forest has been harvested or has died due to fire, insect, or disease. Forests are alive and well. Seedlings germinate, grow, and compete with other seedlings as well as larger trees. Forest regeneration is the cornerstone of long-term forestry. While many forests are being regenerated using natural methods, plantation forestry will be required to increase annual wood harvests. Furthermore, for afforestation on degraded soils, abandoned agricultural fields, or anywhere else where trees are to be reintroduced without a natural seed source, planting is required. According to the most recent FAO forest resource assessment, almost 4.5 million hector are planted per year. Forest management decisions made now will affect the future forest not only in terms of climate and soils, but also in terms of management decisions made today [3].

### The major factors/threat of woody species diversity in Ethiopia

Threats to Woody Species Variety in Ethiopian Forests High wood species diversity typified the rugged terrain of Ethiopia's highlands. For decades, though, they have been deteriorated and fragmented. This deterioration is the result of increased crop cultivation and livestock grazing in marginal areas as a result of population pressure. Furthermore, agricultural investment, resettlement projects, charcoal manufacture, and the continuous development of very aggressive

invasive, living species are all having a significant and determining impact on the availability of woody species resources. In the country's highlands, these efforts resulted to increased deforestation and soil erosion. Forest and wildlife are particularly abundant in Ethiopia's northern and central highlands. Woodlands were once the only "land banks" that were converted to cropland as a result of population growth [4].

**Land degradation:** The phrase "land degradation" refers to a temporary or permanent loss in ecosystem function and productivity through time. As a result, urban expansion, road construction, leisure, forest fires, agriculture, and tree logging are the leading causes of species loss at local, regional, and global scales. All of these things are destroying and degrading the habitats of Ethiopian woody species. Human activities are projected to be the leading cause of risk for 83 percent of endangered plant species. Thousands of contaminants are also released into the environment, and their lasting presence endangers the diversity of woody species by hurting individual species or destroying entire ecosystems. Pollutants are the most serious hazards to species variety, particularly among aquatic species (river, lake, coastal, and ocean), as they kill plants and destroy ecosystems. Woody species diversity is severely harmed in Ethiopia as a result of these practices. These causes have a significant impact on the destruction of natural habitats for many woody species. Such activities are causing the extinction of moisture-loving species while favoring hardy, prickly ones with low societal value. The loss of biodiversity and shifting patterns of woody species have forced an assessment of the region's woody species diversity and a conservation priority list of ecosystems, communities, and species. Ecological management and land degradation control should be undertaken to reduce the risk. It has been an international concern for well over 70 years, whether promoted as soil conservation, reforestation, or some other technique. Land degradation control, on the other hand, has a reputation for being a completely technical endeavor that is self-evidently useful for human society to pursue [5].

Rather than treating the causes and symptoms of land degradation, it has been addressed directly. In addition, raising awareness and providing ongoing training, a relocation program, providing possibilities for alternative sources of income, and encouraging NGOs to participate in land rehabilitation activities can all assist to alleviate the problem of land degradation in Ethiopia [6].

**Deforestation:** The change of wooded regions to non-forest land uses such as arable land, urban usage, logged areas, or wasteland is known as deforestation. When a forest is cleared for agriculture or other uses, the total amount of water and minerals that flow into streams increases dramatically. Deforestation was increasing at an alarming rate in Ethiopia, and the rate of afforestation was minimal in view of the very high rate of clearing for fuel, extending agricultural land, for construction, and urban development goals, as well as a lack of community knowledge [7].

This heavy logging method has a negative impact on the structure and composition of native woody plant species, resulting in a decrease in forest diversity and agricultural productivity in Ethiopia. Such activities constitute a substantial danger to biodiversity conservation and regeneration in general, and plant species in particular. Livestock-induced disruptions may be one of the key causes limiting regeneration and recruitment of woody species, in addition to deforestation. These causes all contribute to the reduction of forest woody species populations. Landscapes with continuous forest are frequently converted to ones with remnant forest patches set in a matrix of non-forest plants as a result of deforestation. This tampering with tropical

habitats has ramifications for biodiversity on a landscape and forest fragment level. Factors such as fragment size, degree of isolation, and time since excision from the continuous forest can all have a direct impact on a fragment's biodiversity, and thus, in a complex way, the biodiversity of the landscape's collection of pieces. The carbon initially contained in forests is released to the atmosphere as a result of deforestation, either quickly if the trees are burned or more slowly when unburned organic matter decays. Only a small percentage of the biomass stored in a forest is used to build houses or other long-term buildings. The majority of carbon is emitted to the environment as carbon dioxide, but decomposition or burning can also release minor amounts of methane and carbon monoxide [8].

**Invasive Species:** Invasive alien plant species are not native to Ethiopia and pose a threat to the country's biodiversity and native flora. The country is facing an increasing environmental and economic challenge. Invasive alien species are the second most important hazard to threatened plant species, behind habitat destruction, according to conservation experts around the world. It is the other major danger that has a significant impact on the diversity of plant species in many parts of the planet. They are a major hindrance to the conservation and sustainable use of global, regional, and local plant species variety, as well as having a considerable negative impact on ecosystem goods and services. *L. camera* is one of Ethiopia's most invasive alien species, wreaking havoc on the health and regeneration of the woody species in which it thrives. It is a highly aggressive invasive species or environmental weed in many countries, according to Solomon (2010) that has a major negative impact on vegetative biodiversity. It usually grows in dense thickets, obscuring natural vegetation and saplings and competing for nutrients. It also has a variety of effects on land resources, agriculture, and livestock production systems, potentially jeopardizing food security. The management of alien species in protected areas is emphasized to reduce the risk of invasive species.

All areas of natural or semi-natural vegetation in which the conservation of the natural community is a significant priority, such as national parks, nature reserves, and wildlife conservation zones, are considered protected areas. Land management outside of a protected area can be critical to the protected area's conservation goals as well as the country's overall conservation goals. Land outside of protected zones, particularly forestry plantations and amenity areas, is frequently used as the primary seed supply for invasive woody species. As a result, alien plant control outside of restricted zones can be critical. The major concerns facing most parts of Ethiopia are the conservation of forest resources and the rising rate of species extinction. As a result of this problem, conservation has become a popular practice in the country. It explores the causes of declining species richness and aims to learn ways to maintain species, communities, and ecosystems. To accomplish so, two ways to protecting and conserving vegetative diversity are being used. These are both in-situ and ex-situ conservation methods [9].

**Agriculture:** The practice of producing plants and cattle is known as agriculture. It was a pivotal event in the rise of sedentary human civilization, as domesticated species farming resulted in food surpluses that allowed people to settle in cities. Agriculture is not just the economy's backbone, but it is also Ethiopians' primary occupation. In many developing nations, like Ethiopia, rapid population growth and a long history of sedentary agriculture have transformed land use/land cover patterns and caused environmental degradation.

The widespread destruction of forests throughout the savannas due to agriculture and other human activity makes the biodiversity losses within parks even more concerning. The spread of agriculture is one of

the factors contributing to the degradation of natural forests. The loss of biodiversity is caused by the destruction of natural forests. Biodiversity loss has a variety of ecological and societal ramifications. More immediately, biodiversity loss can have a major impact on ecosystem function and limit chances to avoid production-related problems. In many developing countries, biodiversity loss has grown as a result of transitioning primary forest to unsustainable agricultural landscapes. One of the most noticeable features of the Ethiopian highlands, for example, is environmental deterioration in the form of deforestation and loss of biodiversity and soil fertility. In Ethiopia's highlands, some 27 million hectares of land have been extensively degraded, with 2 million hectares deteriorated to the point that they would not yield crops in the future [10].

**Physical environment:** Altitude and climate influence the diversity and types of woody plants that grow in a given land use. Temperature and rainfall are two key climatic elements impacted by altitude, both of which have an impact on species diversity. A huge amount of nutrients transit annually between plants and the soil in natural woodland and forest ecosystems; in a climax community, the plant soil system as a whole is in equilibrium, and nutrient inputs and outputs are modest. In monocropping, on the other hand, fertilizer inputs are offset by substantial losses due to accelerated natural processes (leaching, gaseous losses, and erosion) and harvest removal. The amount of recycling that occurs as a result of the decomposition of roots and agricultural leftovers is little. Gathering and processing woody species products can be a primary source of income or a supplement for those who are predominantly engaged in non-forest activities, such as farming. This money can be used to buy food or put towards agricultural assets like cattle or seed to ensure future food supplies [11].

**Ecological degradation:** Ethiopia is rich in biodiversity, with a wide range of biological conditions ranging from arid lowlands in the east to rainforests in the west and high altitude Afro alpine vegetation in the middle highlands. Although there is disagreement over the exact statistics for Ethiopia's former forest cover, historical records suggest that woods originally spanned 35-40% of the country's land area (EFAP, 1994). When savannah woods are included, the estimate jumps to 66 percent of the country. Most of the woods have vanished as a result of ongoing deforestation, and deforestation continues at an alarming rate. Environmental degradation, evident in the degradation of land and water resources as well as the loss of biodiversity, is one of the key issues Ethiopia has in its quest for development. [12]

## Conclusion

Several natural and artificial factors have a significant impact on Ethiopia's forests. Anthropogenic forces primarily affect forests through the increase of agricultural activities, settlement, deforestation, land fragmentation, and the introduction of exotic species, among other things. Protecting forest regions from human and animal disturbance has been used to conserve and manage the remaining forests. Lower forest cover has a variety of repercussions, including soil erosion and diminished ability for watershed protection, which may result in

flooding, as well as reduced capacity and biodiversity loss. As a result, the ecosystem becomes unstable, and the availability of numerous forest goods and services decreases. In Ethiopia, there are insufficient data to make informed decisions about natural forest management. Forest management has been practiced through protecting forest areas from human and livestock interference because today's forest is degraded by many factors, primarily anthropogenic factors, in order to conserve the existence of forests. For further regeneration, forest management has been practiced through protecting forest areas from human and livestock interference because today's forest is degraded by many factors, primarily anthropogenic factors.

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