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Review Article

Article Review on the Determinants and Effects of Deforestation in the Benishangul Gumuz Region of Ethiopia

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Abstract

This paper discusses the determinants and impacts of deforestation in the Benishangul Gumuz region of Ethiopia, which has seen a significant decline in forest coverage from 60% in 1975 to current alarming levels. Deforestation is defined as the conversion of forested areas into non-forest land uses, degradation that diminishes forest quality, and the clearing of native forests for various purposes. The causes of deforestation in the BG region include agricultural expansion, resettlement, shifting cultivation practices, mining activities, population growth, wood collection for construction and fuel, wildfires, ineffective governance, and large-scale investments. These factors contribute not only to environmental degradation but also badly affect socio-economic activities, leading to issues such as soil erosion, loss of biodiversity, deteriorations in honey production, drought prevalence, climate change, rainfall variability, decline of water tables, and a reduction in herbal medicine and wild edible forest foods. In response to the challenges posed by deforestation, the region has initiated several actions aimed at mitigation and restoration of the forests. These campaigns include effective reforestation programs under initiatives like Green Legacy, establishing command posts to preserve forests and biodiversity, implementing watershed management, improving soil fertility, and providing training for farmers on beekeeping and bamboo crafts, which help reduce reliance on shifting cultivation practices. Through these efforts, the region aims to combat the severe effects of deforestation and promote sustainable environmental stewardship.

Keywords

Deforestation, Benishangul Gumuz, Determinants, Region

1. Definition of Deforestation

Deforestation is the conversion of forest to an alternative permanent non-forested land use such as agriculture, grazing or urban development [2]. Besides, deforestation is a conversion of forested areas to non-forest land use, degradation that reduces forest quality, decreases in overall forest cover and clearing native forest land for different purposes [4].

2. Forests and the Nature of Deforestation in Ethiopia

The total natural forest cover of Ethiopia in the 1900s was estimated to be about 40% of the total land area of the country. This was declined to about 11% in 2010 and about 3% in 2015 [7]. Besides, about 42 million hectare or the equivalent to some 35 percent of Ethiopia's total land area was covered with

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forests in 1900 [4]. But, currently the forest coverage has been declining due to deforestations. Besides, currently, the forest coverage of the country is only 3.56% and is still decreasing. It was estimated that between 1990 and 2010, Ethiopia lost an average of forest 140, 000 hectare annually [5]. Additionally, the forest resources of Ethiopia are dwindling at an alarming rate due to natural and manmade factors. The deforestation rate is estimated to be 140,000 - 150,000 ha per year. Ethiopia lost 77% of its forests between 1955 and 1979 due to deforestation. The remaining natural forests of the country could disappear within a few decades unless appropriate and immediate measures are taken [9].

The foremost causes of deforestation in Ethiopia are settlements, agriculture (both small-scale and commercial), extraction of construction materials, grazing, and firewood and charcoal collection, unsustainable forest management, underpinned by poor governance, uncertain land tenure, and a rapidly growing population [7]. Besides, deforestation alters forest habitats, disrupts plant and animal, populations diminishes the biodiversity endangers wildlife survival and affects global climate patterns [3]. Similarly, the ever increasing demand of farmland, fuel wood and charcoal production coupled with population growth has accelerated the rate of forest reduction in Ethiopia [8].

3. The Forest Status in Benishangul Gumuz Region

Benishangul-Gumuz National Regional State (BGNRS) is one of the nine regional states established in 1994 by the new constitution of Ethiopia that created a federal system of governance. The region has international boundary with the Sudan and south Sudan in the West and is bordered by the Amhara region in the North and Northeast, Oromiya in the Southeast and South. The regional capital, Asossa is located at a distance of 687 km west of Addis Ababa, the capital city of Ethiopia [4]. The Benishangul-Gumuz Regional State encompasses 5,043,634.92 hectares of land. The region is characterized by diverse land cover types, with significant ecological and economic value. The region is home to both natural forests and forest plantations. The region holds a significant proportion of Ethiopia's natural forest cover. These natural forests include both lowland bamboo and highland bamboo [5]. Besides, in 1975, before the resettlement program was implemented in the region, almost the entire region was covered with dense forest and open forest, about 40.4% and 25% respectively. And agricultural land and settlement represented only 32.9%, and 1.54% respectively [10]. But, from 1999 to 2022, forestland in the BG region decreased at an average rate of 27.2 hectares per year, primarily driven by agricultural expansion, shifting cultivation, and population pressure [5].

4. The Development of Deforestation in Benishangul Gumuz Region

Deforestation has become a serious challenge today in the Benishangul Gumuz region [7]. Besides, Deforestation nowadays is a burning issue in BG region. The deforestation has been increasing at an alarming rate because of various factors, such as encroachment, forest fires, absence of secure land use policy, effects of agricultural expansion, and intensive resettlement programs [4]. Additionally, Benishangul Gumuz region has faced increasing deforestation and land degradation in recent decades due to various human-induced and ecological factors [5]. Also, the forest has been under rapid rate of deforestation since the implementation of resettlement schemes in 1980s. Nowadays, the Ambessa forest is surrounded by 10 large village associations after the resettlements [7]. Additionally, in the Benishangul Gumuz region, 80% of the forest was cleared for agricultural purposes. The sizes of bamboo forests have been shrinking due to human influences that have gradually contributed to the degradation of lowland bamboo [13]. Similarly, the bamboo forests have alarmingly reduced from 25.6% to 11.6 percent in 1985 and 2001, respectively. The woodland, bamboo forest, and bush lands have declined by 31.7%, 53.9%, and 39.3%, respectively, due to deforestation [4]. Thus, deforestation is a severe problem in the Benishangul Gumuz regional state.

5. The Determinants of Deforestation in Benishangul Gumuz Region

Benishangul-Gumuz Region is known as the land of lowland bamboo, accounting for about 56% of the bamboo forest in Ethiopia. However, deforestation has become a serious problem threatening the biodiversity and the people who depend on bamboo to generate income [4],]16]. The deforestation in the Benishangul Gumuz region happened due to households being increasingly engaged in firewood collection, construction materials and charcoal production as rewarding to sustain their livelihood [10]. Accordingly, many scholars asserted that there are two broader causes of deforestation in the Benishangul Gumuz region: underlying causes of deforestation (direct causes) and immediate causes of deforestation (indirect causes). They stated that the underlying causes of deforestation include population growth, economic growth, income level, and technology. The immediate causes of deforestation comprise factors such as agricultural output prices, agricultural input prices, and employment, credit availability, property rights, land tenure security, timber price, and forest fire [4, 15].

Additionally, the Anbessa forest was destroyed due to population pressure and its resultant effects, such as the prevalence of various types of agricultural activities, resettlement programs, firewood and charcoal production, cutting trees to satisfy the demand for construction materials, and settlement

expansion [4]. The following are the main determinants of deforestation in the Benishangul Gumuz regional state of Ethiopia.

5.1. Farmland Expansions

The expansions of farmland are the main source of deforestation in the Benishangul Gumuz region. Besides, Guyu and Aduwa asserted that large-scale agricultural land investments are the main causes of deforestation in most parts of the BG region [7]. Additionally, in the Benishangul Gumuz region, there is alarming deforestation of natural forests and woodlands for agricultural land expansions. The reason for the high rate of clearance and conversion of forests is to cropland is the fact that the economy of the region largely depends on agriculture [14]. Moreover, the existing expansions of traditional farming practices into grasslands, forests, and shrubland ultimately led to a reduction in forest cover in the Benishangul Gumuz region [10]. Furthermore, the forest was shrunk by 29% over the last 30 years in the Benishangul Gumuz region. Besides, open forest and shrubland decreased at rates of 18% and 9%, respectively, during the same period. In contrast, agricultural land and settlement areas increased at rates of 32% and 24%, respectively, over the period of 30 years [7]. Thus, this clearly shows the effect of the agricultural expansion on the forest in the Benishangul Gumuz region.

Moreover, the land under agriculture and settlement increased at a fast rate. Also, agricultural land increased at an average rate of 888.97 ha/year between 1989 and 2004 and 64.1 ha/year between 2004 and 2019. The average rate of increase of land under agriculture between 1989 and 2019 was 476.55 ha/year [7]. Additionally, the most important cause of deforestation in the Benishangul Gumuz region was found to be crop land expansion, followed by cutting of trees for fuel wood and construction materials [8]. Besides, the farmers who ploughed land with oxen usually require a large farmland to cultivate, as compared to traditional hoe-based farmers. He argued that farmers always clear forests to have large farmlands. Moreover, the farmers used the farmland for many years without giving fallow periods, and the regeneration of the uprooted bamboo usually took a longer time [15, 16]. Additionally, an increase of agricultural land and settlement leads to deforestation in the Benishangul Gumuz region. The conversion of forest land to agricultural land and settlement has increased. The open forest changed into agricultural land by 25%, dense forest changed into agricultural 5.5% [10] Likewise, landholding for farmland expansion leads to deforestation. The farmers usually clear the forest to increase their production. Also, the poor people who are unable to cultivate the land usually clear forest either to reach the minimum subsistence level of food, or clear forest due to the absence, fragility, and scarce resources [5].

5.2. Shifting Cultivation

The shifting cultivation is another factor for the deforestation in the Benishangul Gumuz Region. Besides, the practices of shifting cultivation led to deforestation. The expansion of agricultural land through shifting cultivation and illegal means of land acquisition led to deforestation in the region. Shifting cultivation practices affect an additional 251,681.58 hectares, often resulting in deforestation and soil degradation [5]. Additionally, the shifting cultivation is one of the principal causes of bamboo deforestation in the Benishangul Gumuz region. The farmers clear the forest to practice shifting cultivation. The slash-and-burn farmers often clear the forest for the growing of crops. And these farmers gradually end up with forest degradation and other environmental problems [14, 15].

Moreover, the slash-and-burn agriculture (shifting cultivation) known locally as *gibina* involves clearing forest patches by burning, followed by short-term crop production (usually maize or sorghum) before abandoning the land. This practice degrades soil fertility within 2-3 years, forcing communities to clear new forest areas. Approximately 30% of annual deforestation in the Benishangul Gumuz region is associated with this shifting cultivation, particularly in Metekel and Kamashi zones [5].

5.3. The Forest Fire/ Wild Fire

Wildfire is one of the most serious causes of deforestation in Benishangul Gumuz region [7]. Additionally, the wildfire is a major cause of deforestation in the Benishangul Gumuz region. The highest wildfire occurrence and severe damage were reported in 2012. Also, the annual wildfire occurrence has increased from 53.2% to 98.1% in 2008 and 2013, respectively [14]. Besides, the wildfire emergence has become the most important factor affecting bamboo deforestation. In the Benishangul Gumuz region, uncontrolled wildfire is one of the major causes of deforestation. The wildfire occurs twice a year in the Benishangul Gumuz region. The frequency of wildfire occurrence and the damage it causes to the bamboo forest high especially in Guba woreda and Homosha woreda [4].

There are different causes for the wildfire in the Benishangul Gumuz region. Besides, fire is being used widely as a site clearance technology in the region. The fire is caused by several factors that include: wild honey hunting, site clearance for shifting cultivation and cropland preparation, road clearance for gum and incense tapping; defense against wild animals, and trophy hunting [13]. Besides, fire was the first tool that allowed humans to modify the landscape. It is used to convert closed forests into more open ecosystems favorable to grazing land and crop cultivation. With the diversification of agriculture, fire became the prime tool to clear land for crops [17]. Additionally, as there is no or a weak systematic burning and fire control mechanism in the Benishangul Gumuz region, fires consume huge areas of forest lands. The main consequences of fire and the subsequent deforestation were habitat

destruction and decline of water availability [14]. Thus, the wildfire is the dominant cause of deforestation in the Benishangul Gumuz region.

5.4. Wood Collection for Fuel and Constructions

The wood is the main source of energy and construction materials in the Benishangul Gumuz region. Wood harvest for construction, fuel wood, and other sources of energy leads to deforestation [13]. Additionally, in the Benishangul Gumuz region, over 90% of households rely on fuel wood for cooking, harvesting an average of 3.5 tons per family annually. This demand has created deforestation zones extending 5-10 km around villages [5]. Also, the firewood collection and charcoal production are causes of deforestation with increasing human population growth from time to time [8]. Also, the extraction of the timber causes the deforestation of the bamboo. Besides, deforestation in Benishangul Gumuz happened due to timber production. The society is clearing forests for firewood and charcoal production, which further leads to deforestation [13]. Moreover, the wood may be consumed in the home and also fuel wood used for commercial purposes. Fuel woods and lumber produced for commercial purposes aggravated deforestation in the region. The households cut trees from the forest and sell these forest products at markets [4]. Besides, deforestation is aggravated by the logging and/or burning of trees. The trees or derived charcoal can be sold as a commodity and used by humans, while cleared land is used as pasture, plantations of commodities and human settlement. Likewise, deforestation happened due to woody biomass used for charcoal production, firewood, lumber, and other timber products [4].

5.5. Large-Scale Investments

The large-scale investments aggravate the deforestation in the Benishangul Gumuz region. Besides, unplanned large-scale agricultural land investments are causes of deforestation in most parts of the region [7]. Additionally, the government report revealed that in the Benishangul-Gumuz region, about 691,984 hectares of agricultural land have been transferred to the Federal Land Bank to undertake large-scale agricultural investments. There are huge land-grabbing in the region, which leads to deforestation [13]. Besides, the large-scale agricultural investments and government-led villagisation programs have significantly led to deforestation in the region. These initiatives have often been implemented without adequate consideration for ecological sustainability or local livelihoods. The allocation of vast tracts of forest land to commercial investors has led to rapid deforestation and habitat loss in the Benishangul Gumuz region [5].

5.6. High Population Growth

The rapid population growth is a factor in the deforestation in the Benishangul Gumuz region. Additionally, the population increment needs cultivable land for their livelihood requirements. Also, there are many people who migrated into the region. This situation forced the settlers to encroach into forest areas for cropping, grazing and settlement, which intensified the conversion of vegetation cover [10]. Besides, the high population pressure was the central cause of deforestation in the Benishangul Gumuz region. The high rate of deforestation is high in densely populated areas. The deforestation in the region has risen as the population continues to grow in their unstoppable increase. The vegetation cover of the lowland bamboo is highly threatened in highly populated areas of Assosa and Bambasi woredas [4]. Besides, population growth is one of the root drivers of deforestation under a poorer economy that heavily depends on natural resources extraction for survival. The population is growing due to the characteristic high fertility rate. As populations grow, pressure on forests and other natural resources also increases [14]. Also, population increase has resulted in extensive forest clearing for agriculture, overgrazing by domestic animals, utilization for fuel wood, fodder and construction materials. As the population increases, there is an expansion of crop land, which definitely leads to devastation of the forests [8]. Similarly, the major causes of deforestation are rapid population growth, which leads to an increase in the demand for crop and grazing land, wood for fuel and construction [17].

5.7. Weak Government Organisation

The weak governmental organisations on forest protection lead to deforestation. Besides, the Benishangul Gumuz region does not have a regional formal institution like a forest policy and accompanying acts or legal instruments led to deforestation [14]. Additionally, institutional inefficiency in managing the forest in the Benishangul Gumuz region worsens the prevalence of deforestation in the region [10]. Likewise, the forest governance in the Benishangul Gumuz region is constrained by limited institutional capacity, lack of inter-sectoral coordination, and inadequate enforcement of forest and land use laws, which aggravate the problem of deforestation. Also, some government experts took corruption from investors and allowed large deforestation in the region. Besides, investors took large amounts of forest land and clear the forest for the farmland [5]. Similarly, weak institutions and the prevalence of corruption in the governmental organisations lead to deforestation [17]. Besides, deforestation and poverty are challenging problems in Ethiopia. The deforestation is complicated by the institutional failures related to the management of natural resources [4].

5.8. Resettlement

The resettlement is one of the determinants for deforestation in the Benishangul Gumuz region. Besides, resettlement

in the Ambessa forest led to deforestation mainly for agricultural purposes [10]. Additionally, the resettlement programs have also aggravated deforestation in the Benishangul Gumuz region. Anbessa'chaka forest is one of the popular forest areas of the region, which is facing a serious level of deforestation due to the surrounding resettlements since the 1970s [7].

Moreover, in 1985, a large-scale national resettlement program was carried out by the government in the region, especially around Bambasi district. Following this scheme, the area was characterized by remarkable changes and adverse impacts were induced by resettlement on forest resources. The forest cover rapidly begun to decrease. Also, the open forest and dense forest showed continuous decline in the region from 1970-2019 following resettlements [10]. Similarly, the high rate of migration from different regions of Ethiopia into the Benishangul Gumuz region in search of cropland activated a high rate of conversion of forest woodlands to croplands. The massive migrations into the region for searching virgin land for agriculture is worsen deforestation in the region 14]. Likewise, the large numbers of immigrants were resettled in forests around Assosa, Bambasi and Pawi woredas during the Derg Regime. These factors intensified deforestation and posed other environmental challenges. The resettlement sites were densely covered and destroyed the forests in the region [4]. Additionally, in 1985, during the resettlement program, which was implemented in the Benishangul Gumuz region, the areal coverage of agricultural land and settlement had increased positively, but the coverage of dense forest, open forest and shrub land was decreased due to deforestation [10]. Moreover, resettlement leads to the destruction of forest resources, which is partly associated with population growth and migration. The resettlement and migration increase the pressure on forests, as more land is cleared for agriculture to meet the demand for food and trees are cut for fuel wood, house construction, farm implements and other purposes [9]. Also, the resettlement programs established during the previous and current regimes and refugee settlements are also the driving phenomena to deforestation, which have brought about adverse effects on land use and land cover changes in the Benishangul Gumuz region [10]. Likewise, the new settlements in forests are increasing from time to time and have resulted in deforestation to expand farmlands [17].

5.9. Mining Activities

The mining practice is also one factor for deforestation in the Benishangul Gumuz region. Besides, the mining operations clear forests and lead to deforestation in the Benishangul Gumuz region. In the region, more than 1,010 licensed mines degrade 7,775 hectares, causing deforestation, mercury pollution, and river siltation [5]. Similarly, the weak and insufficient monitoring in the Benishangul Gumuz region on the mining investments affected the forests. It leads to deforestation and other environmental crises. In recent times, coal and marble mining in the Kamashi zone, gold and marble mining in the Asosa zone and marble mining in the Metekal zone have aggravated deforestation in the region [13]. Additionally, the small-scale gold mining, especially along the Dabus and Beles rivers, involves clearing vegetation and digging pits, which destabilizes soils and pollutes waterways. An estimated 15,000 miners operate informally in forested areas in the Benishangul Gumuz region, which further aggravates deforestation [5].

6. The Effects of Deforestation in Benishangul Gumuz Region

The alarming growth of deforestation affected the region in many ways. It has an impact on the socio-economic aspects of society. Besides, Bamboo deforestation has become a serious problem, and it disturbs the economy and ecology of the region. It affects the biodiversity and also the people who depend on bamboo to generate income [4]. Additionally, the consequences of deforestation in the region include reduced wild fruits, reduced wood products and reduced wildlife products. The deforestation causes different environmental problems like an increase in soil erosion and floods, vulnerability to climate change, and biodiversity loss, leading to the destruction of plants and animals' habitats [14]. The deforestation in the Benishangul Gumuz region has the following consequences: -

6.1. Loss of Biodiversity

Deforestation leads to the loss of biodiversity in the Benishangul Gumuz region. Besides, the deforestation for agricultural land and settlements has led to significant habitat loss and fragmentation in the Benishangul Gumuz region. The deforestation threatens biodiversity, alters microclimates, and disrupts watershed functions [5]. Additionally, Bamboo deforestation has many environmental impacts, which include an increase in biodiversity loss, including both fauna and flora species [13]. Likewise, forest loss in the Benishangul Gumuz region leads to a decline in biodiversity, disrupting ecosystems and reducing the habitat for numerous plant and animal species [5].

Similarly, deforestation in the Benishangul Gumuz region led to loss of biodiversity and land degradation. Deforestation affected biodiversity through the loss of both fauna and flora species. Besides, the indigenous tree species and wild animals had disappeared, and the remaining few plants and animals were endangered in the Ambessa forest of Benishangul Gumuz region [10]. Additionally, bamboo deforestation in the Benishangul Gumuz leads to a decrease in the availability of clean drinking water [13].Moreover, deforestation results in declines in biodiversity. The removal or destruction of areas of forest cover has resulted in a degraded environment with reduced biodiversity. Forests support biodiversity, providing habitat for wildlife, and when the forest is cleared, the biodiversity is also destroyed [17]. Similarly, animals' lives in the

Munessa forest are under pressure, facing threats that include habitat loss from forest clearance, agriculture, herding and hunting for food and profit. The indiscriminate exploitation of forest cover has resulted in a degraded environment with a reduction in biodiversity. The lion, red fox, and many bird species left the area because of deforestation [11]. Also, the deforestation leads to loss of biodiversity. The forest and common biomass degradation [1].

6.2. Affected Water

Deforestation has an impact on the water sources and water tables. Besides, deforestation leads to a decline in the water table. Deforestation has a hydrological impact on the environment. It also leads to a decrease in the availability of drinking water [13]. Besides, the water cycle is also affected due to deforestation. Trees extract groundwater through their roots and release it into the atmosphere. When part of a forest is removed, the trees no longer evaporate away this water, resulting in a much drier climate. Also, deforestation reduces the content of water in the soil and groundwater as well as atmospheric moisture [17].

6.3. Decrease of Livestock and Livestock Products

Deforestation also has an impact on livestock and livestock products. Besides, deforestation in Benishangul led to a reduction in livestock and livestock production. He asserted that farmers perceived a decrease in livestock productivity as a result of bamboo deforestation. The decrease in livestock productivity in turn has decreased the livelihood income of the farmers as livestock is the main source of livelihood income [15]. Similarly, deforestation affected the livestock and further affects the economy of the farmers. Livestock is central to supporting and sustaining the livelihoods of farmers. The livestock fulfills an important function in helping people cope with shocks and accumulate wealth, and they also serve as a store of value in the absence of formal financial institutions and other missing markets. But the deforestation activities have been affecting the livestock production. The livestock suffer from starvation. Cattle are exposed to feed shortages due to the impacts of deforestation [11].

6.4. Reduction in Herbal Medicine

Deforestation affects access to traditional medicines. Likewise, the forests foster medicinal conservation. With forest biotopes being an irreplaceable source of new drugs, deforestation can destroy genetic variations (such as crop resistance) irretrievably [17]. Besides, the deforestation leads to damage to the herbal medicine. He asserted that human beings collect the herbal medicines from the forest for different diseases. The *Hagenia abyssinica*, which is used for the removal of tapeworm from the human intestine, is collected from the forest. But, nowadays, with deforestation, the fallow environments where medicinal plants are collected are disappearing, and in extreme cases, they have disappeared, especially *Hagenia abyssinica* [11].

6.5. Affect Honey Production

The loss of the forest due to deforestation affected the honey production. Besides, the loss of forest cover has direct effects on local economies, particularly in areas where communities rely on forest resources for income and subsistence. The beekeeping critical source of livelihoods, but nowadays honey production has been declining with the alarming growth of deforestation in the Benishangul Gumuz region [5]. Additionally, the major problems of Beekeeping in the BG region are related to destruction of the flowering plants owing deforestation for agricultural expansions. Besides, deforestation leads to shortage of bee forage. Furthermore, deforestation tips to elimination of good nectar and pollen producing honey production and processing. Also, recent years have seen environmental changes in prevalence and impact on honeybees and their products in terms of erratic rain fall patterns following deforestation. Thus, the increment of deforestation led to decline of the honey productions in the BG region [6]. Additionally, deforestation badly affected beekeeping. The beekeepers have placed the hive in a tall tree, and some are placing it under the house. The productivity of traditional hives is extremely low due to deforestation [11].

6.6. Soil Erosion

Deforestation affects soil fertility and leads at soil erosion. Besides, deforestation hints at declining land productivity in the Benishangul Gumuz Region. The deforestation disturbs the soil fertility and leads to soil acidity that further affects household food security, particularly for subsistence farmers [5]. Additionally, deforestation causes soil erosion. The deforestation has caused the depletion of soil nutrients, contributing to low agricultural productivity and constrained household resources [1].

Furthermore, deforestation results in exposing soils to various erosion agents. It leads to the grass and other plants stunted growth due to soil erosion. The deforestation increases rates of soil erosion by increasing the amount of runoff and reducing the protection of the soil from tree litter [11]. Besides, deforestation leads to soil erosion and loss of soil fertility. The deforestation reduces soil cohesion, so that erosion, flooding and landslides ensue. Deforestation generally aggravates rates of soil loss by increasing the amount of runoff and diminishing the protection of the soil [17].

6.7. Drought and Climate Changes

Deforestation leads to climate change and drought prevalence. Besides, there are shortages of rainfall in the Benishangul Gumuz region due to deforestation. Temperature change

was another deforestation-inducing problem in the region. It increases from the east to the west with decreasing elevation. Nowadays, the monthly temperature increased in the range between 22 and 27 ℃ due to deforestation in the region [14]. Additionally, the semi-arid to arid climate of Benishangul Gumuze, characterised by prolonged dry seasons and erratic rainfall, inherently restricts vegetation growth. The increasing temperatures and shifting rainfall patterns under climate change are likely to exacerbate existing stressors. The prolonged droughts and heat waves may push marginal vegetation systems beyond their ecological thresholds [5]. Likewise, deforestation is ongoing and affecting the climate. He stated that deforestation is a contributor to global climate change and a cause of the enhanced greenhouse effect. Tropical deforestation is responsible for approximately 20% of the world's greenhouse gas emissions. The deforestation mainly in tropical areas accounts for up to one-third of total anthropogenic carbon dioxide emissions [17]. Besides, the deforestation causes drought. He argued that in Ethiopia, drought is an extended period of time during which rainfall is deficient. Drought occurs when sufficient water needed to sustain an area is not available [11].

6.8. Reduction in Wild Edible Plants Food

Deforestation affects the forest products used for the foods. Besides, deforestation has brought about adverse effects on land use and land cover changes in the Benishangul Gumuz region. Deforestation affects the food products obtained from the forests. Also, deforestation leads to a reduction in wild edible plants. This further affects the socio-economic aspects of the society [10]. Additionally, many people obtain a large amount of food from the forest. The people obtain fruits, vegetable and wild gums from the forest. During seasonal food shortages and other periods of hardship, forest food is relied upon to provide nutrition to the people. Forest resources are also sold to generate extra income in amounts that can be quite substantial. But the deforestation has been affecting the food sources obtained from the forests in the region [11].

7. Promising Environmental Campaigns in Benishangul Gumuz Region

There are some initiatives, both at the federal and regional levels, to reduce deforestation in the Benishangul Gumuz region. Besides, the federal government has initiated several national-level interventions, including the green legacy initiative, which promotes massive tree planting and reforestation in the region. Also, the Ministry of Agriculture supports integrated watershed management and soil fertility enhancement programs in the Benishangul Gumuz region, which have been working to mitigate deforestation in the region [5]. Likewise, there are improvements in forest cover in the Benishangul Gumuz region following the green legacy initiative at the national level, and reforestation programs are increasing in the region. The improvement is due to the effects of massive tree planting (afforestation and reforestation) since the last three years. The Benishangul Gumuz region agricultural and rural development bureau reported that 8, 715 hectares of land were covered with tree plantation in 2013 alone. During that time, about 4,345.5 kg varieties of forest seeds and 23, 616, 666 seedlings were distributed to farmers [4]. The main cause for deforestation in the region is slash and burning practices. Thus, to reduce shifting cultivation practices, the Benishangul Gumuz regional state introduced beekeeping and bamboo craft training in 2020 for the farmers. The aim of the program is to reduce dependence on slash-and-burn farming for 12,000 households to reduce deforestation practices [12].

Additionally, the Benishangul Gumuz regional state has implemented area closures and natural resource protection policies. The collaborative projects with international NGOs and donors have aimed at restoring degraded lands through community-based approaches. The local communities protect their environment through grassroots efforts, including the construction of soil bunds, terraces, and reforestation programs. These community-based environmental protections have been showing changes in the region. The community-based natural resource management groups are increasingly involved in the protection of forests and water sources. And the forest covers have been regenerating in the region [5]. Furthermore, there are community associations created in the Benishangul Gumuz region to control the wildfire in the region and protect the forests from the wildfire. They asserted that the community fire management, collaborating with the village leaders, established firebreaks around 60 high-risk forests in 2023 in the Benishangul Gumuz region [12]. Besides, recent operations on the Ethiopian forest plantation through community participation indicate that plantations enhance the recruitment, establishment and succession of native woody species by functioning as foster ecosystems. Forest plantations established on degraded sites long devoid of a native tree cover act as successional catalysts, facilitating the recolonisation of native flora and faunal [17].

Moreover, Ethiopia has embarked upon an intensive afforestation application, particularly because the flip of its new millennium through a campaign “Two Trees for 2000”. Since then, it's been transplanting numerous tree seedlings throughout its territory to repair its wooded area depleted regions [1]. Besides, the Government of Ethiopia has dedicated important efforts to the conservation of the country’s biodiversity, including the formulation of policies for the sustainable use of genetic resources. The green legacy has been showing some progress in the forest coverage of the country. Also, the protected areas cover 14% of the country and contribute significantly to conserving the diversity of the forest genetic resources. There are 40 wildlife conservation areas in Ethiopia comprising 9 national parks (2.3 million ha.), 4 wildlife sanctuaries (1 million ha), 8 wildlife reserves and 18 controlled hunting areas [11].

8. Conclusion

Deforestation refers to the conversion of forested land to non-forested uses such as agriculture, grazing, or urban development. In Ethiopia, the natural forest cover has dramatically reduced from nearly 40% in the 1900s to just 3.56% in recent years. The Benishangul-Gumuz region, which comprises diverse forest types, has seen a significant decline in forest cover. Deforestation in the region has increased since the 1980s due to resettlement projects, leading to distressing rates of forest degradation. Species such as bamboo, which account for a significant portion of the forest, have also faced severe reduction. The expansion of farmland remains the foremost driver of deforestation, reflecting the region's agricultural dependency. In spite of the substantial increase in agricultural and settlement lands, forest converges continue to reduce at alarming rates. Moreover, the main causes of deforestation in the region include population growth, miming activities, resettlement programs, shifting cultivations and large investment expansion into the region. To sum up, the interaction of farmland expansion, shifting cultivation and wildfires critically destroys the forests of the Benishangul Gumuz Region, underlining the urgent need for sustainable land management practices. The region is facing significant socio-economic and ecological consequences due to deforestation. The main consequences of deforestation include loss of biodiversity, as habitat loss disrupts ecosystems and endangers various species. Deforestation negatively disturbs water sources, leading to lower water tables and reduced availability of clean drinking water. The livestock and livestock production also suffer from decreased productivity, which impacts farmers' livelihoods, while access to traditional herbal medicines is compromised due to the destruction of forest biotopes. Honey production also declines as forest resources diminish, affecting local economies. Further, soil fertility is degraded, contributing to increased soil erosion and reduced agricultural productivity. To alleviate these issues, campaigns like the Green Legacy Initiative focus on afforestation, community participation, and sustainable land management, showing promising improvements in forest cover and biodiversity conservation.

Abbreviations

BGNRS	Benishangul Gumuz National Regional State
FDRE	Federal Democratic Republic Ethiopia
BG	Benishangul Gumuz
KM	Kilo Meter
NGO	Non-governmental Organization

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Conflicts of Interest

The author declares no conflicts of interest.

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