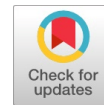


The Threat and Ecological Benefits of Ethiopian Orthodox Tewahdo Church Forests in Ethiopia: A Review Paper

Abesh Birhanu Morka



Abstract: Ethiopian Orthodox Tewahdo Church Forests have multidimensional functions and uses to mankind and other living organisms. This review paper summarises the benefits and threats of Ethiopian church forests within the boundaries of Ethiopian Orthodox Tewahido Churches. It focuses on biodiversity conservation, emphasising the importance of seeds and seedlings of native vegetation, ecological value, ecosystem services, and benefits to the community and the world in general. The contribution of forests to biodiversity conservation and climate change mitigation is significantly high. However, evidence showed a decrease in forest coverage to produce crops for household consumption. As a result of these factors, the species diversity of natural forests is decreasing. In such difficult conditions, the church forest has been used as a habitat for different plant species. As reported by various scholars, numerous indigenous and IUCN Red List species existed around the church area. In terms of species diversity, the forest around the church is comparable to that of natural forests. In addition to the conservation role of the church forest, the conserved plant species significantly contribute to climate change mitigation through carbon stocks in biomass and soil. Trees in the church area have a long-life history and higher stand structure parameters, such as maximum height, DBH, and crown diameter, and their carbon storage potential is also maximum. Overall, church compounds are serving as hot spot sites for biodiversity conservation and play a significant role in mitigating climate change by limiting greenhouse gas emissions and increasing the amount of carbon removed and stored in forests. It also emphasizes the main threat of these church forests in Ethiopia are deforestation, overgrazing, anthropogenic encroachment, invasive alien species, human population growth and conflict and war. Conservative management of church forests involves protecting them from livestock, managing human use, and actively restoring degraded areas to ensure their long-term health and biodiversity.

Keywords: Ethiopia, Church Forest, Ecological Benefits, Orthodox Tewahido

Nomenclature:

IUCN: International Union Conservation
EOTC: Ethiopia Orthodox Tewahido Church
NTFPs: Non-Timber Forest Products
CSA: Central Statistical Agency
PFM: Participatory Forest Management
CFI: Carbon Farming Initiative

Manuscript received on 14 May 2025 | First Revised Manuscript received on 04 September 2025 | Second Revised Manuscript received on 06 October 2025 | Manuscript Accepted on 15 October 2025 | Manuscript published on 30 October 2025.

*Correspondence Author(s)

Abesh Birhanu Morka*, Associate Researcher, Department of Forest and Rangeland Plant Biodiversity, Ethiopia Biodiversity Institute, Assosa Biodiversity Research Centre, Assosa, Ethiopia. Email ID: birhanuabesh12@gmail.com, ORCID ID: [0000-0003-2464-484X](https://orcid.org/0000-0003-2464-484X)

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I. INTRODUCTION

Globally, about 13 million hectares of forest were degraded per year. Most of this change occurred in the tropics [26]. The Ethiopian Orthodox Church is one of the earliest churches in the world [19]. The area has a long history of planting and protecting trees around churches [33]. The Ethiopian Orthodox Tewahido Church are found all over the world, including Japan, Morocco, India, Ghana, and Ethiopia. In Ethiopia, significant forest covers are found in and around churches, monasteries, graveyards, mosque compounds and other sacred sites [13]. The benefits provided by forest ecosystems include: goods such as timber, food, fuel and bio products. Ecological functions such as carbon storage, nutrient cycling, water and air purification, and maintenance of wildlife habitat. Social and cultural benefits include recreation and traditional resource uses. Forests play essential roles in the life support systems of our planet, benefiting both mankind and other living organisms. Forests play crucial roles in the life support systems of our planet, benefiting both mankind and other living organisms. However, biodiversity is highly degraded in Ethiopia.

In fact, not only Ethiopia but also various types of the world's natural forests are degraded due to the search for forest products, agricultural expansion and settlement [25]. Church compounds are safe places for trees and other biodiversity resources, where one can nurture trees that might have been destroyed forever, under the shelter of the church's values and esteem. In other words, church compounds are serving as in-situ conservation and hot spot sites for biodiversity resources, mainly indigenous trees and shrubs of Ethiopia, which, in turn, give prestige to the religious sites [34].

The Ethiopian Orthodox Tewahido Church has a long history of planting and conserving tree species. Church compounds are the monasteries of trees and other biodiversity resources, where one can animate trees that have escaped destruction under the shelter of the church's values and esteem. Many indigenous trees and shrubs that were destroyed over the last century are still found standing in the compounds of rural churches.

Church compounds are serving as conservation sites and hot spots of biodiversity, mainly indigenous trees and shrubs of Ethiopia, which, in turn, give prestige to the religious sites [37].

Deforestation has a long history in Ethiopia, especially in the northern parts of the country, and this activity is



accelerating. Due to this activity, the forest cover of the country was about 16% of the land area in the early 1950s and rapidly declined to 3.6% in the early 1980s and 2.7% in 1989. Different scholars reported that the annual deforestation rate, as estimated by [14], was 141,000 ha yr⁻¹. A significant increase in the yearly average deforestation rate was observed in 2015, reaching 210,000 ha per year. Due to forest deforestation and degradation, valuable natural forest remnants, especially in the northern and central highlands of Ethiopia, have been preserved in ancient church and monastery grounds.

In such difficult conditions, sacred areas, especially Churches, serve as a means of preserving biodiversity. Numerous plant and animal species used sacred areas as a habitat [34]. Furthermore, religious areas serve as conservation sites and hot spots of biodiversity, mainly indigenous trees and shrubs of Ethiopia [37].

A. Objective of the Review Paper

This review paper clearly states the ecological importance of church forests in protecting biodiversity and providing goods and environmental services to the community in Ethiopia. Finally, it states that this paper compiles the conservation strategies of traditional, religious (EOTC) doctrine and indigenous knowledge for Sustainable Forest Management in Ethiopia.

II. METHODOLOGY

This work is based on secondary sources of information using literature searches. This review attempts to organise all pertinent information about the key roles of EOTC forests, challenges, and prospects as studied by the church forest survey in different parts of Ethiopia over the period from 2000 to 2023. Data were obtained from an extensive and intensive review of related literature, including published articles, conferences, annual reports, and books. Peer-reviewed journals were selected and intensively reviewed from worldwide accepted scientific databases, Scopus and Web of Science, indexed based on relevancy and relatedness to the topic.

A. What is Church Forest?

Church forests are religious places and social centres that enhance the community's material well-being and social capital by allowing social networks to develop and thrive. They are a type of sacred forest (also referred to as holy groves or fetish forests).

Church forest communities consist of peasants (i.e. small landholders who are subsistence-oriented farmers); they are not groups of hermits adhering to an archaic practice. Community members, including priests, live in the immediate vicinity of their local church and usually from three to four villages (gots). A ring of native forest of variable size surrounds what is usually a round EOTC church [9]. Church forests provide a safe habitat for plants and animals, serve as sources of food and traditional medicine, act as seed banks for native tree species, reduce soil erosion, and are rich in biodiversity.

B. Historical Background of the Ethiopian Church Forest

Historically, most of the church forests were destroyed and burned with the churches and other precious heritages by the anti-Christian expedition led by Ahmed Ibn Ibrahim, also called 'Grag', meaning 'left-handed', at the beginning of the 16th century. After 'Grag' had been killed in 1543, most of the churches and monasteries were reconstructed together with their forests. In the process of nationalisation of private properties during the socialist regime, the EOTC was left without its land holdings, including the forests, which had been preserved for centuries. The fate of those forests was ruthless exploitation and destruction, which in turn brought a severe reduction in biological diversity and ecological imbalance as well.

Ethiopia has a total of around 35,000 churches and monasteries, some of which are 1660 years old. The oldest Ethiopian Orthodox Churches date from the 4th century. Most of these churches are in the Northern and Central Highlands of Ethiopia [28].

It is one of the earliest churches in the world, managing the surrounding forest using its own religious justifications. These justifications are the spiritual bond between tree plantation and conservation, based on the holy Bible and religious thought. These forests remain sanctuaries for many endemic and endangered plant and animal species that have nearly disappeared in most parts of northern Ethiopia. The forests, also known as sacred groves, have been preserved for many centuries due to the strong biblical basis, theological thoughts, religious beliefs, and commitment of the communities [34].

In Ethiopia, there are more than **35,000** individual orthodox church forests in the region, ranging in size from 3 hectares (7.4 acres) to 300 hectares (740 acres), with the average around 5 hectares (12 acres). It is estimated that these church forests represent the bulk of the remaining forested land in the Ethiopian Highlands [25] [36].

The area of forest cover preserved by the Ethiopian Orthodox churches in some parts of the country has declined and is now found in patches. These patches of forests are used as sources of seeds for raising seedlings in nurseries.

The local people call these churches with the surrounding trees "debr" or "geddam". These places are religiously considered holy and are also socially respected and powerful institutions among the followers [35]. The people with strong beliefs in the religion that attend the church ensure the protection and vigilance of their sacred groves, rather than relying on formal policing or other community efforts in the region [28].

The forests around the churches are local and global hotspots because they are critical conservation areas providing ecosystem services [5]. Some of these recently established churches have developed a forest around them through rehabilitation processes that are not the natural Afromontane forests. These church forests possess woody indigenous tree species.

III. BENEFITS OF CHURCH FORESTS

Church forests provide a safe habitat for plants and animals, serve as sources of food and traditional medicine, act as seed banks for native tree species, reduce soil erosion, and are rich in biodiversity. But the economic values of these critical benefits of church forests were not well documented. In Ethiopia, significant forest covers are found in and around monasteries, graveyards, mosque compounds, churches, and other sacred sites. Specifically, the Ethiopian Orthodox Tewahido Church has a long history of planting and protecting trees around churches to maintain their forest cover. There are numerous sacred areas or forest patches in the world [4] [5].

Comparatively, the number of sacred forests in Ethiopia is lower than in Ghana (2,000 sacred forests) and even lower compared to India, which has nearly 100,000 sacred forests [31]. In Ethiopia, most sacred areas are located near churches and monasteries. Ethiopia has more than 35,000 church communities, and most of the churches are in the Northern and Central Highlands of Ethiopia [34].

Most of the church area is covered by various types of vegetation. In other directions, particularly in the southwest of the country, Ethiopia, the role of natural forests is replaced by shade coffee cultivation and home garden agroforestry systems [22] (Solomon, 2015). Various plant species around the grass of the church area have provided services to the communities through their spiritual and medicinal values [40].

The local people near the church forest use the plant species as timber. Non-timber forest products (NTFPs) include sources of income, agricultural implements, tools, household furniture, folk medicines, washing powder, insecticide, fumigants, aromatic ingredients, gum, ropes, tannery, food, fodder, bee forage and beehives, light, fuel and charcoal, construction, lumber, shade, and shelter [15].

A. Church Forests as an in-situ Biodiversity Conservation Hotspot

Church compounds are serving as conservation sites and hot spots of biodiversity, mainly indigenous trees and shrubs of Ethiopia, which, in turn, give prestige to the religious sites. The churches and monasteries of the EOTC are often surrounded by a small natural forest characterized by a high floral and faunal diversity with many indigenous and rare species [9].

The churches have natural forest vegetation rich in biodiversity, which hosts a variety of plants and animals. Their vegetation consists not only of trees but also shrubs and herbs, and they constitute essential habitats for a variety of animal species [6]. Different plant species provide services to communities through the spiritual and medicinal values attached to them [40].

Church forests provide a safe habitat for plants and animals, serve as sources of food and traditional medicine, act as seed banks for native tree species, reduce soil erosion, and are rich in biodiversity. But the economic values of these critical benefits of church forests were not well documented. In Ethiopia, significant forest covers are found in and around monasteries, graveyards, mosque compounds, churches, and other sacred sites. Specifically, the Ethiopian Orthodox Tewahido Church has a long history of planting

and protecting trees around churches to maintain the forest cover of the area.

There are two kinds of church forests in Ethiopia, where primary forests surround churches older than five hundred years. In contrast, recently established churches from the last decades are observed alongside secondary forests. In this case, the older church forests are characterised by a high floral and faunal diversity, with many indigenous and rare species. These closely located forests are ecologically crucial for forming corridors, facilitating species exchange, and distributing genetic resources in conservation [32].

Sacred groves are ideal sites for species afforestation programs in their specific localities (in situ) and could serve as models of sustainable forest management and biodiversity conservation. Many endangered species of flora in Northern Ethiopia are found surrounding churches and Monasteries [28]

The EOTC is making a sustained effort to teach and advise the clergy and the people living in the community; highlight the need to protect existing trees; induce the desire to plant and look after newly planted trees, and care for indigenous trees and plants [34]

The church forests, sanctuaries for many indigenous species protected in various agro-ecological and climatic zones, could serve as germplasm for regeneration and biodiversity conservation [28]. The two tree species, *Juniperus procera* and *Prunus africana*, which are listed in the IUCN red list, are primarily found in church forests of Ethiopia. Sacred groves are often safe places for trees and other biodiversity resources. In other words, church compounds are serving as in situ conservation and hot spot sites for biodiversity resources, including many endemic and endangered species, mainly indigenous trees, and shrubs of Ethiopia [12].

B. For Biodiversity Conservation

As stated by Wassie [34], the main theological bases and religious perspectives in conserving forest resources are: the Church on earth signifies and symbolises the new heaven, the holy city, New Jerusalem, coming down from God out of heaven, prepared as a bride adorned for her husband. The church of Eden was so beautiful, with many plants, animals, and other organisms, and the holy water/streams infinitely surpassing those from these forests, which were believed to proceed from the throne of God. Even though the primary purpose of the church is for worship, burials, and meditative religious festivals, it also provides a good and secure habitat for diverse plant and animal species. EOTC has a long history of planting, protecting, and preserving old trees in churches and monasteries [1].

Thus, forest resources around churches are essential for biodiversity conservation and mitigating climate change [32]

Comparatively, the church forest has a higher number of indigenous species than exotic species. A study in 78 selected church forests reported that all 148 recorded plant species were indigenous to Ethiopia [1]. Another study in Church forests in the Highland landscape of Ethiopia also reported that 160 plant species were

indigenous. The remaining eight species were exotic to Ethiopia from the recorded 168 plant species [32].

Churches and Monasteries are also places where various endangered and IUCN red-listed plant species (*Juniperus procera* and *Prunus africana*) occur [28]. As reported by Aerts and his Colleagues [1], *Olea europaea ssp. Cuspidata*, *Juniperus procera*, *Croton macrostachyus*, and *Calpurnia aurea* were the most common shrub species, having relative frequencies of 0.71, 0.67, 0.54, and 0.76, respectively. Ethiopian Scholars also proved that *Juniperus procera* and *Olea Africana* were the most common species in the monasteries of the Goba District, Southeastern Ethiopia [23]. Lasta Woreda, North Wollo Zone, Amhara Region, Ethiopia, and six selected church forests in the North Shewa Zone of the Amhara Region, Ethiopia [28]. Evidence showed that Fabaceae is the most species-rich family in the Ethiopian church forest [7].

C. Church Forest for Ecosystem Services

Church forests provide ecosystem services for pioneer organisms across various landscapes and serve as stepping stones for restoration, contributing to long-term forest sustainability, biodiversity conservation, and social benefits. They also provide valuable, often unique, and secure habitats for plants and animals, as well as green spaces for people to relieve stress. Dense, forested, and well-protected sacred groves confer prestige to religious sites, which are respected and believed to receive many blessings from the presence of angels within the compound of such churches [34].

Forest restoration and genetic conservation in the degraded highlands of Ethiopia depend on the remnant church forests and a few trees around farms [27]. In addition, these forests provide other essential ecosystem services, including non-timber forest products, climate change mitigation through carbon sequestration, spring water and moisture, and spiritual and cultural value [12].

D. Ecological Values of Church Forests

Church forests are among the last remnants of Ethiopia's historic Afromontane forests, which date back to the 4th century. They are ecologically important as: (i) the only natural seed source for native Ethiopian trees, (ii) a place hosting birds, insects, reptiles, and vertebrates (a reservoir for biodiversity), (iii) a source of freshwater springs including holy water and hydrological services for nearby farmland, and d) a place for soil and water conservation [28] (Tilahun et al., 2015).

Church forests provide essential ecosystem services to local people, including freshwater, pollinators, honey, shade, and spiritual value. In other cases, sacred forest patches have been planted, or small and degraded forest patches expanded and restored through enrichment planting by communities seeking to enhance cultural, economic, and ecological benefits from forested areas [21] (Reynolds et al., 2017).

Church forests help provide a space for prayer and contemplation, burial lands, access to medicinal plants, carbon sequestration, temperature regulation, soil erosion prevention, and habitat for a range of species. It is estimated that there are about 35,000 church forests scattered across Ethiopia. Several conservation organisations have been involved in mapping and protecting these forested islands.

Church forests also harbour pollinator species, including native bees and other insects that add value to outlying crops. These forests also provide food, medicine, construction materials, and architectural works, as well as other essential human needs for the local community [3]. According to Wassie [34], their disappearance would be a disaster for plants, animals, soil nutrients, and moisture, leading to a degraded area in northern Ethiopia.

Even though anthropic and natural factors threaten these church forests, they serve as safe habitats for plants and animals, sources of food and traditional medicine, seed banks for native tree species, provide shade and conditioned atmosphere for religious festivals, sweet and pleasant smell around churches, reduce soil erosion, are rich in biodiversity, grace for the church and harbour pollinator species [21].

E. Church Forest used for Researchers

Church Forest is a learning and scientific research centre for researchers. Protecting the church forest is not only for the conservation of natural resources but also for serving researchers and academicians as field laboratories/centres/sites for practical training and research in biology, ecology, forestry, pharmacology, sociology/anthropology, socio-economics, forest history, etc. Church forests and Monasteries are excellent learning and research centres in general, and they are ideal sites for studies on vegetation history, ecology, taxonomy, and other fields of biology and forestry [28].

Generally, although the primary purpose of churches is as places for worship, burials, and meditating during religious festivals, they also provide valuable, often unique, and secure habitats for plants and animals, as well as ecological values and green spaces for people. Besides being rich in biodiversity, these spiritually designated forests sequester carbon, help to regulate climate change, conserve water, reduce soil erosion, and provide shade and natural medicine.

They are native seed banks for the future of the given landscape. They also harbour pollinator species, including native bees and other insects that add value to outlying crops [18].

F. For Carbon Sequestration in Mitigating Climate Change for Climate Change Mitigation

Forest patches which exist near and around Churches are critical in carbon sequestration and climate regulation. Since trees around the church area are well protected from various disturbances like cutting, their carbon sequestration potential through above and below ground biomass is significantly higher [29].

The performance of trees also affects the amount of carbon stored, indicating that healthy and larger-diameter trees have good potential for sequestering carbon [20]. Thus, the trees around the church are of a long age and have a large diameter, which enhances their ability to absorb carbon dioxide. Studies on the church Forest in Addis Ababa, Ethiopia, reported that 129.85 and 25.97 t ha⁻¹ of aboveground and belowground biomass carbon were stored [29]. A similar study at the same research site reported biomass carbon of 147.49 and 24.58 t ha⁻¹ above and below

ground, stored by the church forest [40].

In addition, due to the presence of vegetation cover, soil erosion is reduced. Soil and water are well conserved; as a result, soil organic carbon stock is well enhanced [28]. Studies on soil organic carbon stocks in the church forest by [29] reported 135.94 t ha⁻¹ and [23] reported 127.9 t ha⁻¹ in Addis Ababa, Ethiopia, and Goba District, Southeastern Ethiopia (Teklehaymanot Monastery Forest), respectively.

G. Climatic Change

Climate change mitigation can be achieved by limiting (Preventing) greenhouse gas emissions and by enhancing the activities that can remove these gases from the atmosphere. Limiting global warming to below or close to 1.5 °C from pre-industrial levels would require decreasing net emissions of greenhouse gases by around 45% by 2030.

It is required to remove 100-1000 GtCO₂ over the 21st century to achieve the limit of global warming to 1.5°C [16] (IPCC, 2018). One option for slowing down the rise of greenhouse gas concentrations in the atmosphere, and thus possible climate change, is to increase the amount of carbon removed and stored in forests [8] [10].

When trees grow, they sequester carbon in their tissues, and as the amount of tree biomass increases (within a forest or in forest products), the increase in atmospheric CO₂ is mitigated. The ability of these plantations to sequester carbon has received renewed interest. Carbon sequestration projects in developing nations could receive investments from companies and governments wishing to offset their emissions of greenhouse gases through the Kyoto Protocol's Clean Development Mechanism.

Carbon Sequestration is the process of capturing carbon dioxide and storing it to reduce the accumulation of greenhouse gases in the atmosphere [8]. Church forests can sink carbon to mitigate the greenhouse gas emissions that drive climate change [30].

Forests play a significant role in climate change mitigation by sequestering and storing more carbon from the atmosphere than any other terrestrial ecosystem. Church forests, including other sacred places, are relatively more protected than forests in other areas.

According to various scientists, the contribution of church forests to reducing atmospheric carbon concentration can be estimated by conducting case studies in a few selected churches around Addis Ababa. He found the following amounts of CO₂ stored in both above-ground and below-ground biomass from seven church forests in Addis Ababa.

IV. THREATS TO CHURCH FOREST IN THE ETHIOPIAN ORTHODOX TEWAHIDO

In Ethiopia, significant forest patches are found in and around monasteries, graveyards, mosque compounds, churches and other sacred sites. Specifically, the Ethiopian Orthodox Tewahido Church has a long history of planting and protecting trees around churches to maintain their forest cover. But the forests are threatened by livestock grazing, harvesting of timber and non-timber forest products, conversion to farmlands and the replacement of indigenous trees by economically important tree species. Consequently, the forests are decreasing both in size and density, with visible losses in biodiversity.

A. Deforestation

Deforestation due to demographic pressures, along with increasing demand for firewood, grazing, construction, and agricultural land, made the conservation of these remnant church forests a very challenging task. These, together with sedentary farming, lead to persistent land exploitation in Ethiopia, which has made farmers degrade the environment and invade the church forest surrounding [11]. In some cases, the line that separates the church forest from community agricultural land became blurred (Yarded, 2001) [41]. The church forests' resources have been degraded due to human settlements and utilisation [42].

The conservation of monastery and church forests is becoming beyond the capacity of churches to save them from the pressure of local people for agricultural land expansion, grazing, and destructive timber production. The issue of ownership aggravated the rate of deforestation by the surrounding people. The Ethiopian Orthodox Tewahido Church should be entitled to its forests. This increases the recognition of monastery and church forests and can be considered as one of the forest ownership categories by the government [28]. The threats to church forests owned by EOTC include:

B. Overgrazing

Livestock grazing is the primary factor limiting seedling establishment, seedling survival, and growth in church forests [38]. Overgrazing results in decreased soil cover, increased erosion, elimination of the natural regeneration of plant species and loss of biodiversity. It also removes the saplings and shrubs of forests, reducing their regeneration. Studies in the Ethiopian highlands showed that heavy grazing pressure significantly increased surface runoff and soil loss, reducing the soil's infiltration capacity, which in turn undermines the suitability of sites for germination [28].

C. Anthropogenic Encroachment

Encroachment into the church forests by individuals for farmland expansion, for settlement, plant logging for lumbering and fuel wood collection. This leads to a decline in the sizes and diversity (richness and evenness) of the forests. The critical shortage of fuel wood and farmland causes the encroachment by the local people [28]. The decision to conserve and sustainably use forest resources by humans is determined by culture. This aspect of preserving biodiversity is referred to as cultural diversity, recognising the critical role of sociological, ethical, religious, and ethnobotanical values in human activities [34].

D. The Invasive Alien Species

According to [28], the destructive impacts of invasive alien species were identified in the Kewet and Yifratana Gidim districts, affecting the Afar and Dessie regions. Among the invasive species, *Lantana camara* was replacing most of the shrub plant species at a very rapid rate. This intensification extends to the right of Tarnaber to Menz Guassa plains and terrains from Shewa robit to Ataye. In these areas, it quickly takes over indigenous herb and shrub species [17].

The prominent alien species that cause damage across the

country include *Parthenium hysterophorus*, *Prosopis juliflora*, *Eichhornia crassipes* and *Lantana camara*. *Lantana camara* is becoming a significant problem by replacing natural vegetation in shrubby areas. This problem is intensified from Shewa robit to Kombolicha. Extreme care is required in the selection of species to be introduced to minimise any impact on native species [28].

E. Human Population Growth

Although the EOTC and its doctrine have a strong initiative to conserve their sacred groves, the growth of the human population has increased the demand for trees for firewood, construction, income sources, and gathering. This high population growth, accompanied by sedentary agriculture and extensive cattle husbandry, competes with the church forests for agricultural land and grazing. Thus, religious followers have inadvertently threatened the forests through agrarian land expansion, grazing, footpaths to churches, and the production of firewood, charcoal, and timber [28].

In addition, societal requirements of buildings like gathering houses, monuments and cemented graves caused the clearance of trees and resulted in a permanent disturbance. Cultivating fast-growing exotic species (*Eucalyptus*) and native trees (*Coffea*, *Rhamnus*, etc.) for church financing as a cash crop also critically disturbs the forest [9].

F. Conflict and War

Historically, most of the church forests were destroyed and burned with the churches and other precious heritages by the anti-Christian expedition led by Ahmed Ibn Ibrahim, also called 'Gragñ', meaning 'left-handed', at the beginning of the 16th century. After 'Gragñ' had been killed in 1543, most of the churches and monasteries were reconstructed together with their forests [34].

During the nationalisation of private properties in Ethiopia in 1974, as part of the socialist regime, the central aspect was land reform. The land reform proclamation was adopted in 1975, and all rural land was nationalised. The EOTC was left without its land holdings, including the forests, which have been preserved for centuries. The fate of those forests was ruthless exploitation and destruction, resulting in the degradation of the area [28].

V. CONSERVATION OF CHURCH FOREST IN EOTC

According to UNESCO (2003), sacred natural areas are model sites for management because they integrate cultural, social, and natural values within a single management system and can serve as models for participatory conservation. In legally protected areas with a resident population, the integration of sacred natural sites can improve people's attitude toward protected area regulations. The church forest is essential for preserving traditional knowledge. Adapted forest conservation practices are often found in sacred natural sites and serve as healing sanctuaries [3].

Traditional ecological knowledge is often applied in the management of ecosystems, thus providing good

opportunities for integrating Western science and traditional knowledge systems, according to [12]. The spiritual faiths, which most people follow, impact the natural environment: this interaction can occur through the sacredness of places and/or the influence of faiths. Since the existence of sacred areas within a protected area can create a challenge for managers, decisions about whether to designate a holy area important to faiths as an officially protected area need to be made on a case-by-case basis. The Convention on Biological Diversity realised that many areas of the world with high biodiversity are anthropogenic landscapes inhabited by indigenous and local communities. Approaches have been refined to link conservation initiatives with local culture and religious views [2].

A comprehensive understanding of the cultural context (indigenous knowledge in this case) of a given community is necessary for biodiversity conservation activities. Understanding the role that church forests play in the provision of ecosystem services is critical, particularly for soil conservation, freshwater protection, and carbon sequestration. To preserve these forests, and perhaps even expand them, a multidisciplinary approach that includes all stakeholders—biologists, social scientists, ethnographers, religious leaders, and local people—must collaborate. Understanding the relationship between regional peoples and the forest is the way to empower the community to protect and conserve the forest [9].

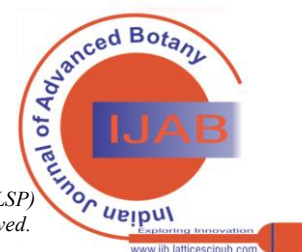
According to Terefe [24], community participation is crucial to overcoming the rate of deforestation. For this purpose Participatory Forest Management (PFM) which is adopted and implemented by involving the local community who intimately related to forest resources to fulfill the interest, respecting of traditional users, their culture (indigenous knowledge in this case) and religious contribution in saving the forest of the country from small scale to large scale and bottom-up approach which encourage a sense of belongingness to the rural people in general and landless rural youth in particular [39].

VI. CONCLUSIONS AND RECOMMENDATIONS

Ethiopian Orthodox Tewahido Church Forests are crucial sources of both faunal and floral resources, particularly for endangered and endemic species, as they provide germplasm, especially tree seeds, for the conservation of these species. The multi-purpose roles of church forests are demonstrated through their religious aspects, biodiversity conservation, and climate change mitigation. Even though the churches were established to meet the religious and spiritual needs of the local community, they are playing essential roles in biodiversity conservation hotspots. Church forests serve as a destination for numerous indigenous, endemic and IUCN red list plant species. Due to the diverse nature of church forests, the stand parameter is well-kept, and soil erosion is also reduced. As a result, the carbon sequestration potential through biomass and soil is significantly higher. Grazing of church areas frequently poses a challenge in Ethiopia.

A. Recommendation

- Studies should be conducted on the status



of conservation, regeneration, and structure of sacred grove ecosystems, and determining factors affecting them for the better well-being of indigenous species to be preserved for future generations.

- The government should acknowledge the church for conservation; ensure a clear boundary for the church forest to minimise further encroachment, and work together in enforcing the legal protection of the forest.
- Researchers must fill the gap of churches and monasteries in doing scientific forest management practices, like inventories of the forest's resources and a forest management plan to protect them from decline.
- The participatory forest conservation program will be more successful if the knowledge of the local community, indigenous cultures, and religious institutions (particularly of EOTC), with a cooperative effort, is taken into consideration.

ACKNOWLEDGMENT

The authors are thankful to all individuals whose studies have been incorporated into this review. The authors also extend they're thanks to the reviewers for providing constructive comments that significantly improved the paper.

DECLARATION STATEMENT

Some of the references cited are older, noted explicitly as [2], [3], [4], [5], [6], [8], [9], [10], [11], [12], [13], [14], [19], [20], [24], [25], [27], [29], [30], [31], [32], [33], [34], [35], [36], [37], [38], [39], [40], [41] and [42]. However, these works remain significant for the current study, as they are pioneering in their fields.

After aggregating input from all authors, I must verify the accuracy of the following information as the article's author.

- **Conflicts of Interest/ Competing Interests:** Based on my understanding, this article has no conflicts of interest.
- **Funding Support:** This article has not been sponsored or funded by any organisation or agency. The independence of this research is crucial for affirming its impartiality, as it was conducted without any external influence.
- **Ethical Approval and Consent to Participate:** The data provided in this article is exempt from the requirement for ethical approval or participant consent.
- **Data Access Statement and Material Availability:** The adequate resources of this article are publicly accessible.
- **Author's Contributions:** The authorship of this article is attributed only to the author

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AUTHOR'S PROFILE



Mr. Abesh Birhanu Morka is an Associate Researcher in the Ethiopia Biodiversity Institute, Assosa Biodiversity Research Centre, Department of Forest, and Rangeland Plant Biodiversity. He obtained his first degree in Applied Biology (BSc.) from Bahir Dar University and a second Degree in Ecology and Conservation Biology (MSc) from Wollega University in 2014 and 2018, respectively. I have four years of experience working on the conservation of biodiversity, traditional medicinal plants, and Indigenous knowledge. He has published articles in peer-reviewed and significant Journals. I published a total of six scientific papers in important scientific journals, as well as review articles, seminars, and various scientific workshops.

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