Indigenous Knowledge-Based Conservation of Plant Diversity in Central and Western Ethiopian Afromontane Vegetation

Zewdie Kassa[1] and Hurume Degefa[2]

Abstract

The Afromontane forest vegetation of Ethiopia spans large areas of the country, thriving at a range of altitudes from 1500 to 2600 meters above sea level (moist evergreen montane forests) and 1600 to 3300 meters above sea level (dry evergreen montane forests). These forests are home to a rich diversity of plant and animal species. The study was conducted in central and western Ethiopia to evaluate indigenous knowledge-based approaches to plant diversity conservation. Semi-structured interviews were used to gather ethnobotanical data, and a total of 396 informants were surveyed. The study documented 313 plant species, 200 of which are used for medicinal purposes. This biologically diverse ecosystem faces numerous natural and anthropogenic threats, leading to significant degradation and biodiversity loss. However, indigenous communities have developed traditional practices over millennia that promote biodiversity conservation, management, and sustainable use. These practices are applicable to both ex-situ (homegardens) and in-situ (wild habitats) conservation strategies. Local communities use plants for various purposes, including food, medicine, construction, culture, and rituals. Indigenous knowledge plays a crucial role in traditional resource management and biodiversity conservation.

Key Words*: Biodiversity, emic view, ethnobotany, etic view, medicinal plants.*

The Afromontane forest vegetation of Ethiopia, as described by Friis *et al*. (2010), covers a large portion of the country across a wide range of altitudes, from 1500 to 2600 meters above sea level (moist evergreen montane forests) and from 1600 to 3300 meters above sea level (dry evergreen montane forests). This region is home to a rich diversity of plant and animal species. The floristic richness and endemism of the Afromontane vegetation are particularly high due to the varying

[1] PhD in Botany, Salale University College of Natural Sciences, Department of Biology zewdiekasa911@gmail.com

[2]] Salale University College of Social Sciences and Humanities
Kennaajaalalaa@gmail.com

altitudes and diverse climatic conditions (Friis, 2009; Vivero *et al*.,2006; Sebsebe Demissew *et al*., 2005).

The Ethiopian flora consists of 6027 vascular plant species, 27 of which are subspecies (Ensermu Kelbessa and Sebsebe Demissew, 2014; Friis, 2014). These plants are distributed across fourteen floristic regions, with the Shoa Upland ranking second, just after the Sidama floristic region (Friis *et al.*, 2009). While Afromontane vegetation is increasingly threatened by various anthropogenic disturbances, indigenous practices continue to play a crucial role in the conservation, management, and sustainable use of these vegetation resources, both in-situ (in the wild) and ex-situ (in homegardens).

Materials and Methods

An assessment of the use of indigenous ecological knowledge by local communities was conducted through semi-structured interviews, field observations, and guided field walks. The role of plants and plant-based products in cultural practices and rituals was also observed. Visits were made to sacred sites to explore the influence of worship and cultural beliefs, such as TOORA SAFUU, on conservation efforts. Ethnobotanical fieldwork methods were employed following Alexiades (1996) for data collection from informants. Additionally, the methods outlined by Martin (1995) were used to record both the emic and etic perspectives, with local people's indigenous knowledge documented accordingly.

The information gathered from indigenous knowledge was interpreted within a scientific framework, focusing on its contribution to biodiversity conservation, management, and sustainable use. Plant specimens collected during the study were identified using plant taxonomic keys and characteristics, with reference to the *Flora of Ethiopia and Eritrea* volumes 1-8 (Hedberg *et al.*, 2009; Friis, 2006; Mesfin Tadesse, 2004; Edwards *et al*., 2001; Edwards *et al*., 2000; Edwards *et al*., 1997; Edwards *et al*., 1995; Phillips, 1995; Hedber *et al.*, 1989; Thulin, 1989). Identification took place at the National Herbarium (ETH) at Addis Ababa University, as well as the mini-herbarium at the Salale University Botanical Sciences Laboratory. The identified specimens were verified, authenticated, and stored for future reference, ensuring they could be used by students and researchers.

Diversity Estimation

The Shannon Diversity Index (H') represents the average uncertainty per species in a community with an infinite number of species (S) of known proportional abundance. The index is calculated using the population parameters, denoted as Pi:

$$Shannon\ Diversity\ Index\ (H') = \sum_{i=1}^{S} PilnPi = \sum_{i=1}^{S} [\{\frac{ni}{n}\}\ln\{\frac{ni}{n}\}]$$

where n_i = the number of individuals belonging to the i^{th} of S species in the sample, n= the number of individuals in the sample, Pi = $\frac{ni}{n}$, the probability of sampling species i, ln $\{\frac{ni}{n}\}$ = the natural logarithm of the probability of sampling species i. Shannon's equitability (J) was calculated to test species evenness as: $Equitability\ (J) = \frac{H}{Hmax} = \frac{H}{lnS}$, where S is species richness, lnS is the natural logarithm of the species richness and J assumes the values between 0 and 1 with 1 being with complete evenness (Kindt and Coe, 2005; Magurran, 2003). Diversity, richness, and evenness values were calculated using a data frame in R statistical software for diversity analysis.

Results

Plant Taxonomic Diversity

A total of 313 plant species from 220 genera and 81 families have been documented, including approximately 200 medicinal plants. Among the documented species, 44 are trees, 82 are shrubs, 170 are herbs, and 17 are climbers.This ecosystem, rich in biological diversity, faces numerous challenges from both natural and human-induced factors, leading to significant degradation and biodiversity loss. Indigenous communities possess traditional knowledge accumulated over thousands of years, which they use for conserving, managing, and sustainably utilizing biodiversity.

The Emic versus Etic View in Relation to Indigenous Knowledge

Local Classification of Agro-climatic Zones (AZ) and Associated Knowledge: From an emic perspective, local communities classify agro-climatic zones (AZ) into three main categories based on elevation and climate characteristics. These zones are: the highland agro-climatic zone, referred to as *BADDAA* (Highlands); the midland agro-climatic zone, known as *BADDA DAREE* (Midlands); and the lowland agro-climatic zone, called *GAMMOOJJII* (Lowlands).

The highland agro-climatic zone is located at altitudes ranging approximately from 2600 m to 3100 m. It is characterized by a cool, dry climate with a unimodal rainfall pattern, where rain-fed agriculture is the primary economic activity. The main crops grown in this zone include *Hordeum vulgare* (barley), *Triticum* (wheat), peas, beans, *Solanum tuberosum* (potato), and *Allium sativum* (garlic), with potato and garlic being the primary commercial crops alongside those used for household consumption.

The midland agro-climatic zone, known as *BADDA DAREE* (Midlands), is situated at altitudes ranging from 2200 m to 2500 m. This zone is characterized by a relatively warm, dry climate with unimodal rainfall, supporting both rain-fed agriculture and small-scale irrigation systems as the primary agricultural practices. The main crops grown in this zone include wheat, *Eragrostis tef* (TEFF), faba beans, *Pisum sativum* (peas), *Zea mays* (maize), and *Guizotia abyssinica* (NUUGII).

The lowland agro-climatic zone, known as GAMMOOJJII/Lowlands, encompasses areas with altitudes ranging from 1200 m to 2100 m. This zone is characterized by a hot and dry climate. The primary agricultural activities include rain-fed farming and cattle rearing. Dominant crops in the region include *Eragrostis tef*, *Sorghum bicolor*, maize, and *Guizotia abyssinica*. This classification is compared with the national agro-climatic zoning, which divides the country into highlands (2500-3000 m), midlands (1500-2500 m), and lowlands (1500-2000 m).

The local people classify wild vegetation into various categories based on the size, growth form, and services provided by the plants. These categories include KALOO, MARGA, TUSII (GUFTEE), HURRUMA, CIRAA, MICIREE, DAGGALA, BOSONA, and CAFFEE. In ecological terms, these classifications correspond to grasslands, grasses and sedges, herbs, shrubs, trees, bushlands, forestlands, and wetlands. KALOO refers to grazing land, either large or small in scale, which can be either protected (individual) or unprotected (communal). It is primarily used by local farmers to obtain feed and fodder for cattle. Protected KALOOS are typically accessible to the local community only during the dry season, a state locally known as GADIDHIISAA or DIRIIRSAA. MARGA refers to grass and its associated herbaceous plants, which are consumed by grazing animals. TUSII (GUFTEE) includes small, shrubby or non-shrubby plants, either herbaceous or woody, which are smaller than HURRUMA. HURRUMA refers to small, often shrubby plants and their associated species. CIRAA describes small, shrubby or non-shrubby plants found in farmlands and their associated habitats. This category is particularly significant to farmers, as it must be cleared before farming activities continue. Farmers also associate CIRAAs with crop pests. MICIREE refers to complex plant associations dominated by dense, shrubby growth from the base, similar to scrublands. These areas have limited significance as grazing lands or sources of wood compared to grasslands and forestlands. Finally, BOSONA represents forest vegetation with herbaceous and shrubby layers in the understory.

Local legend suggests that certain vegetation categories, particularly Afromontane forests, are nearly lost today. Currently, only a few remnants of these forests exist, often in state-managed forests or private plantations. Historical accounts and traditional forest naming practices in some regions reveal those forests like *BOSONA ABBAA FIIXEE* and *BOSONA ABBAA JOOTEE* were once dominant, characterized by species such as *Juniperus procera*, *Olea europaea*L.subsp. *caspidata*, *Podocarpus falcatus*, and *Hagenia abyssinica*. However, these Afromontane forests are now completely extinct in the areas where they once thrived. *DAGGALA* refers to dense, impenetrable plant associations, often found in the wild or in herbaceous-woody complexes around homegardens, which provide limited services to humans. Farmers typically clear these areas to make use of the fertile soils for agriculture. *CAFFEE*, on the other hand, refers to wetland vegetation made up of herbaceous plants, grasses, and sedges that remain evergreen throughout the year or become swampy after the rainy season. The vegetation of *CAFFEE* is a vital source of feed and fodder for livestock, especially during the dry season. It is also believed to be home to many endemic species, making it a priority for conservation efforts.

The local people classify landscapes based on the land's geomorphology and elevation. The main landscape categories used by the indigenous community include DIRREE or GOODAA (Plain), SULULA or HARAA (Valley), QARREE (Hill), TULLUU (Mountain), HALLAYYAA (Cliff), RAAREE (Swampy and riparian areas), and EDEDA (River banks).

Based on soil characteristics, land fertility, and physiographic features, the local people classify land into various categories. These include LAFA CABAREE (gravel land with scattered shrubs), LAFA CORREE (infertile land along riverbanks at lower altitudes, characterized by red soil and relatively higher temperatures where malaria is a common health issue), LAFA DIIMILEE (land with red soil), LAFA CIRRACHAA (land with sandy soil), LAFA QALJII (land with fertile soil), and LAFA SAQAA or LAFA QOMAA (land along hillsides or block mountains). Additionally, land can be classified based on its use and services, such as LAFA QONNAA (land suitable for plowing), LAFA DHEEDICHAA (grazing land), and LAFA BORQII (infertile land unsuitable for plowing). These traditional land classifications align with modern land use systems, highlighting the importance of local traditions and experiences in both extensive and intensive land use practices, as well as in-situ and ex-situ conservation approaches.

Vegetation Classification Visually by Dominant Plant Species /Emic Versus Etic Categories/

To understand the distribution of plants and plant associations based on dominant tree species and plant community types, visual observations were conducted. The findings were then categorized according to traditional altitudinal classification systems. Specific dominant tree species were selected to represent the visual vegetation and plant communities. As a result, seven distinct plant community types were identified and described as follows.

- *Juniperus Procera-Hagenia Abyssinica Dominating Plant Community Type*

This plant community is primarily found at altitudes ranging from 2500 m to 3060 m according to traditional classification. It dominates undulating and plain landscapes. The key plant species in this vegetation include *Hagenia abyssinica*, *Juniperus procera*, *Dombeya torrida*, *Erica arborea*, *Buddleja polystachya*, *Discopodium penninervium*, *Prunus africana*, *Apodytes dimidiata*, *Ekebergia capensis*, *Ficus sur*, *Myrica salicifolia*, *Podocarpus falcatus*, and *Olea europaea* subsp. *caspidata*. These species are typically scattered in farmlands, along roadsides, and near homegardens, often as remnants of the original vegetation.

- *Ekebergia Capensis-Ficus Sur Dominated Plant Community Type*

This plant community is found at altitudes ranging from approximately 2400 m to 2700 m. The dominant plant species in this vegetation type include *Ekebergia capensis*, *Ficus sur*, *Acacia abyssinica*, *Olea europaea*L.subsp. *cuspidata*, *Apodytes dimidiata*, *Allophylus abyssinicus*, *Maesa lanceolata*, *Rhus glutinosa*, *Myrica salicifolia*, *Podocarpus falcatus*, *Erythrina brucei*, *Maytenus* species, *Scheffera abyssinica*, *Juniperus procera*, and *Prunus africana*. These species are scattered along hillsides, farmlands, plain wooded grasslands, and riverbanks, often as remnants of the original vegetation.

- *Croton Macrostachyus-Cordia Africana Dominated Community*

This vegetation occurs where the midland and highland vegetation zones converge, typically between altitudes of 1900 m and 2400 m. The dominant plant species recorded in this community include *Croton macrostachyus*, *Cordia africana*, *Acokanthera shimperi*, *Salix subserrata*, *Ficus vasta*, *Allophylus abyssinicus*, *Albizia schimperiana*, *Millettia feruginea*, *Euclea divinorum*, *Acacia abyssinica*, and *Olea europaea*L.subsp. *cuspidata*. This vegetation is characterized by relatively dense woody species compared to the previous two communities.

- *Combretum Molle-Euclea Divinorum* Dominatedcommunity

This vegetation zone is found at altitudes ranging from approximately 1500 m to 2000 m, where midland and lowland vegetation meets. It is characterized by dense and impenetrable scrubs and acacia woodlands. The dominant plant species in this area include *Euclea divinorum*, *Combretum molle*, *Acacia albida*, *Acacia persciciflora*, *Ozoroa insignis*, and *Syzgium guineense*.

- **Anogeisus** *Leiocarpa-Dichrostachyus Cinerea Dominated Community*

This vegetation primarily occupies the partial midland and lowland areas, typically between altitudes of 1200 m to 1900 m. It faces significant threats from fire, overgrazing, and deforestation. The dominant plant species in this zone include *Anogeissus leiocarpa*, *Dichrostachyus cinerea*, various *Acacia* species, *Commiphora africana*, *Boswellia papyrifera*, and *Oxytenanthera abyssinica*.

- *Eucalyptus globolus-Cupressuslusitanica* dominated community

This type of vegetation is found in tree plantations around towns, homegardens, roadsides, and farmlands, typically at altitudes ranging from 2000 m to 3060 m. It is characterized by areas dominated by Eucalyptus plantations, which have become a significant source of income and are gradually replacing croplands.

- *Riverine Vegetation*

This type of vegetation is found along riverbanks and streams. The dominant plant species in this vegetation include *Salix subserrata*, *Ficus sur*, *Myrica salicifolia*, *Millettia ferruginea*, *Syzgium guineense*, *Croton macrostachyus*, and *Epilobium hirsutum*. The riverine vegetation in the study area also contains remnant plant species that are only found in a few locations where disturbance is relatively low.

General Features of Homegardens

Field observations revealed significant variations among homegardens across different altitude ranges, Kebeles (the smallest administrative units), and agro-climatic zones. These homegardens also vary in size, shape, and orientation. In terms of production systems, both rain-fed and irrigation-based homegardens were identified. It was further observed that homegardens are either annuals, where production occurs continuously throughout the year, or perennials, where production is dependent on rainfall and thus seasonal. Certain plant species that persist throughout the extended growing season are selected to characterize the homegardens. Based on these observations, four types of homegardens were identified.

- *Lagenaria Cicerraria-Cucurbita Pepo Based Homegardens*

In this type of homegarden, *Lagenaria ciceraria* and *Cucurbita pepo* are the dominant plant species, thriving for an extended period throughout the year. These homegardens were primarily observed at altitudes ranging from approximately 1500 m to 2000 m. They are relatively less complex in terms of plant diversity, with fewer species recorded. The main plant species found in these gardens include *Lagenaria ciceraria*, *Cucurbita pepo*, *Ipomoea batatas*, *Capsicum annuum*, *Helianthus annuus*, *Zea mays*, and *Sorghum bicolor*.

- *Saccharum Officinarum-Musa Paradisiaca* Based Homegardens

These homegardens are predominantly dominated by *Saccharum officinarum* and *Musa paradisiaca* throughout the year. They are more complex in terms of plant species diversity compared to other homegardens. These gardens also incorporate partial small-scale irrigation-based production systems. They are primarily found at altitudes ranging from approximately 1900 m to 2200 m. The main plant species recorded in these homegardens include *Saccharum officinarum*, *Musa paradisiaca*, *Citrus limon*, *Citrus sinensis*, *Coffea arabica*, *Catha edulis*, *Nicotiana tabacum*, *Beta vulgaris*, *Brassica* species, *Aframomum kororima*, *Carica papaya*, *Persea americana*, *Colocasia esculenta*, *Capsicum annuum*, *Allium sativum*, *Zea mays*, and *Sorghum bicolor*.

- *Ensete ventricosum-Allium cepa based homegardens*

In these homegardens, *Ensete ventricosum* and *Allium cepa* are the dominant plant species throughout the year. The production systems are primarily based on small-scale irrigation, alongside rain-fed cultivation. These homegardens are commonly found at altitudes ranging from approximately 2300 m to 2600 m in the study area. The complexity of plant species recorded in these gardens is similar to that of the *Saccharum officinarum-Musa paradisiaca* based homegardens in the area. The main plant species found in these homegardens include *Ensete ventricosum*, *Allium cepa*, *Allium porrum*, *Allium sativum*, *Schinus molle*, *Arundo donax*, *Becium filamentosum*, *Beta vulgaris*, *Brassica* species, *Capsicum annuum*, *Catha edulis*, *Cicer arietinum*, *Colocasia esculenta*, *Foeniculum vulgare*, and *Lippia adoensis*.

- *Solanum Tuberosum-Allium Porum Based Homegardens*

In these homegardens, *Solanum tuberosum* and *Allium porrum* are the dominant plant species, thriving throughout the extended season of the year. These homegardens are commonly found in the extreme highland areas, typically between altitudes of 2500 m to 3060 m. They are less complex in terms of the number and variety of plant species compared to other homegardens. The dominant plant species identified in these gardens include *Solanum tuberosum*, *Allium porrum*, *Rhamnus prinoides*, *Allium sativum*, *Ensete ventricosum*, *Ruta chalepensis*, *Cymbopogon citratus*, *Artemisia afra*, and *Leonotis raineriana*. The local people derive multiple benefits from these vegetation resources, which are used for various purposes, including medicinal, wild edible plants, construction and tools, shading, cultural and ritual practices, and sacred sites for worship.

Diversity Analysis

The Beta diversity, measured through the Sørensen index of dissimilarity, was calculated for paired comparisons of sites and was found to be 0.80. This value indicates the degree of beta diversity across the sample sites. To assess alpha diversity, both the Shannon-Wiener and Simpson diversity indices were utilized. Diversity index was calculated to see the overall diversity of the study area. The area is with relatively high plant species diverse at H'= 3.40 with overall species evenness, J= 0.60 approximately.

Discussion

Local Categories of Vegetation and Landscapes and the Associated Knowledge

Some local names given to landscapes and vegetation, when associated with specific plants, animals, or humans, provide valuable insights into the historical significance of certain places. This is a key concept in ethnobotany. For instance, the names *Hara Calalaqa* and *Goodaa Waleensuu* refer to small areas near the *Malkaa* River basin. These names suggest that *Apodytes dimidiata* was the dominant tree species around *Hara Calalaqaa* and *Erythrina brucei* was prevalent around *Goodaa Waleensuu* in the past two to three decades. However, these areas are now largely cleared for farming, with only a few scattered remnants of *Apodytes dimidiata* and *Erythrina brucei* remaining.

Moreover, the presence of remnant Afromontane species scattered throughout certain areas offers valuable clues about the dominant vegetation of the past. Today, what the local people refer to as *Bosona* (meaning forest land) is primarily scrubland, found in the western extremes, with remnants of Afromontane tree species now limited to farmlands, pocket areas, and roadsides, rather than well-defined forests. Thus, local names are closely linked to the dominant vegetation types of the past and reflect the farmers' traditional ecological knowledge (FTEK). Ethnobotanists can use these ancient names to gain insights into the historical plant-human relationships and the changes in the environment over time. This understanding can help inform recommendations for conservation efforts and guide actions in natural resource management.

Although both natural and anthropogenic factors were identified as major threats to vegetation, the majority of these factors are driven by human activities. The priority ranking of perceived threats to vegetation revealed that population pressure, agricultural intensification, and tree cutting ranked first, second, and third, respectively. This suggests that these factors are interconnected, with one often being a direct consequence of another, leading to overall habitat modification.

The findings of this study align with Frankel *et al.* (1995), who argued that the primary threat to plant species is not over-harvesting, but rather the destruction and conversion of their habitats for other uses. However, it is important to consider Cunningham's (2001) perspective on the impacts of harvesting. Cunningham emphasized that the effect of harvesting on individual plants can vary depending on which part of the plant is used. Therefore, it is essential to approach this issue from a multi-dimensional perspective.

On one hand, factors perceived as leading to habitat destruction and environmental degradation also pose a significant risk to the regeneration of natural plant populations, potentially causing mass extinctions. Field observations confirmed that many areas that were once home to dense natural plant populations are now barren lands due to slash-and-burn agriculture. As a result, entire plant species have been lost from these areas. A notable example of this is the extinction of a complex plant community once dominated by *Erythrina brucei*, *Apodytes dimidiata*, *Prunus africana*, and *Myrica salicifolia*. Interestingly, even though this plant community disappeared decades ago, the local names associated with these species still exist, along with a few remnant trees. Some of these local names include *Goodaa Waleensuu* (meaning plain land of *Erythrina brucei*), *Haraa Calalaqa* (meaning valley of *Apodytes dimidiata*), *Qarree Baroodoo* (meaning hilly slope of *Myrica salicifolia*), and *Tulluu Gurraa* (meaning mountainous slope of *Prunus africana*). This raises an important question for ethnobotanists: what can we learn from such evidence? These local clues could be valuable for designing ecosystem and habitat conservation strategies, as well as for rehabilitation efforts and enhancing the resilience of species in their natural environments, where they are best adapted.

On the other hand, there are clear instances where harvesting has threatened certain plant species. Notable examples include the rootbark harvesting of *Securidaca longipedunculata* for its medicinal and non-medicinal uses (such as its pleasant fragrance and role as a washing agent), as well as the root harvesting of *Cucumis ficifolius* and *Thalictrum rhynchocarpum* for medicinal purposes. Additionally, the Ethiopian Biodiversity Institute (EBI), formerly known as IBC (2000), has noted that *Securidaca longipedunculata* and *Hagenia abyssinica*, both recorded in the area, are among the threatened species. Furthermore, *Cucumis ficifolius* ranks among the top ten medicinal plant species with high informant consensus (27%), though it has a narrow altitudinal range (1500-2100 m) in the area.

The narrow altitudinal range of these species, combined with their high medicinal demand from the local population, has placed them under significant threat, as reported by the informants. As a result, these three plant species have become increasingly scarce and are not as easily accessible as they were two to three decades ago. This finding aligns with Cunningham's (2001) assertion that the knowledge and perceptions of resource users, such as traditional healers and commercial medicinal plant harvesters, provide valuable insights into the scarcity of important plant species. In such cases, we must agree with Cunningham's argument that, long before conservation biologists, local resource users are often the first to notice resource scarcity, as they are willing to travel farther or pay more to obtain these increasingly rare plants. Our conclusion is that the knowledge and perceptions of these individuals offer efficient shortcuts for compiling local inventories of important species, saving both time and money, and enabling biologists to monitor key species, as Cunningham (2001) already highlighted.

The Shannon-Wiener and Simpson Diversity Indices

The Shannon-Wiener and Simpson diversity indices were calculated to assess the average uncertainty in predicting the species to which an individual, randomly selected from a collection of S species and N individuals, would belong. The Shannon diversity index (H) was found to be 3.40, with a P value of 0.05, while the Simpson index, calculated as 1 - P, averaged 0.95. This indicates relatively high diversity, though it is lower than the diversity indices reported in other studies, such as Ermias Lulekal (2014), which reported an H' value of 4.07 for the dense forests of Ankober District in the North Shewa Zone of Amhara Regional State, Ethiopia.

The Shannon-Wiener equitability (J) is calculated as H/Hmax = H/log(S), where S represents the number of species. For this study, the equitability was 0.60, reflecting a moderate degree of species evenness. It should be noted that a higher Simpson index suggests lower diversity, making it more informative to consider the reciprocal value or report 1 - Simpson index (Kindt and Coe, 2005). The overall Shannon-Wiener index (H' = 3.40) and species evenness (J = 0.60) indicate high species diversity, consistent with Friis (2009), who described the Shewa floristic region as one of the most species-rich areas next to Sidamo in the Ethiopian flora regions.

Conclusion

In conclusion, this study highlighted that the area is rich in both plant diversity and medicinal plant resources. The high plant diversity can be attributed to the varied topographic features and broad altitudinal range. Additionally, the local culture of using traditional herbal medicine to address various health issues is closely linked to the abundant diversity of climatic and topographic conditions, which contributes to the large number of medicinal plant species in the area.

Recommendation

There is a need to encourage community-based conservation efforts, supported by the scientific community. Therefore, special attention should be given to the indigenous knowledge of local resource users, particularly regarding how they have preserved and protected valuable species on their lands for generations. This knowledge should be recognized and encouraged.

Authors' Contribution

Zewdie Kassa designed the study, collected data, analyzed the data, and prepared the manuscript. Hurume Degefa concentrated on language editing, checked whether the local Afaan Oromoo terms used through the manuscript were properly spelt and proofreading of the manuscript.

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