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Biodiversity and ethnobotanical significance of vascular plants in the ecological trail and reservation site of indigenous trees (ECOTRIS), Ifugao Province, Philippines

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Abstract

This study examines the macrofloral diversity and ethnobotanical significance of the Ecological Trail and Reservation Site of Indigenous Trees (ECOTRIS) in Ifugao Province, Philippines. The site is compartmentalized into four distinct land-use areas: an arboretum of native trees, a bamboo plantation, a fern grove, and a grassland with patches of trees. Biodiversity assessments were conducted across three plots established near the water tributaries, revealing the highest diversity index in the midstream plot, attributed to its dense canopy structure. Biodiversity indices using the Shannon index showed that the sampling plot near the stream had the highest value (3.02). In contrast, sampling sites near the marginal land and bamboo plantation had values of 2.56 and 2.78, respectively. Similarity indices indicated that Plot 1 had the highest similarity attributed to the high presence of pioneering species dominating the canopy, while Plot 3 exhibited lower species. Species Importance Value (SIV) analysis highlighted the pioneering species, particularly *Melanolepis multiglandulosa* Merr. dominated the sampling area. The study documented 22 edible plant species and 35 ethnobotanically significant trees, underscoring local floras' cultural and medicinal value. This research emphasizes the ecological and cultural importance of preserving indigenous species and highlights the need for sustainable management practices to mitigate human-induced disturbances in the region. The findings underscore the potential of ECOTRIS as a field gene bank, advocating for sustainable management and the integration of indigenous conservation practices to enhance its ecological value and heritage.

Keywords

ecological; ethnobotany; indigenous; macroflora; reservation; SIV

Introduction

In the world, particularly in the Philippines, traditional medicine has incorporated medicinal plants for centuries, especially in rural communities (1). Ethnobotany, which studies the relationships between plants and people, is an academic field believed to have originated in the 19th century (2). Ethnobotany is a multi-disciplinary science encompassing various fields, including systematics, taxonomy, pharmacognosy, pharmacology, phytochemistry, ecology, and conservation biology (3). Using herbal plants, documented in folklore as traditional remedies, has been a vital aspect of cultural heritage worldwide (4). Indigenous populations have established resourceful applications for their locally available natural resources due to the abundance of these plants (5). Indigenous communities, including the Ifugao cultural group, have relied on ethnobotanical plants as a crucial part of their healthcare practices (6).

Several ethnobotanical studies highlight the importance of understanding these indigenous plant-based practices and aim to preserve cultural heritage (7). Science in this field is inherently multi-disciplinary, with numerous journals dedicated to the topic (3). While ethnobotanical surveys have been conducted among many indigenous and non-indigenous groups throughout the Philippines, there is still much more to discover (8). Statistics indicate an increasing demand for alternative and nature-based sources of safe, effective, and affordable medicine (5). Additionally, the gradual integration of Western medicine alongside modernization poses a risk of extinction for traditional practices (9). Ethnobotanical research in the Cordillera region is quite limited; some of this research is site-specific, with the most recent studies dating back only five years. Therefore, this study is being undertaken mainly because many local communities still have few written records (5). The increasing demand by consumers for sustainable, health-promoting foods has compelled research into plant-based products and the commercialization of plant-derived medicine by-products (10).

The Ecological Trail and Reservation Site of Indigenous Trees (ECOTRIS) was established in 2019 by the Department of Forestry at the College of Agriculture and Sustainable Development at Ifugao State University to serve as a repository for native trees in the province and nearby communities. It became a laboratory site for Forestry students studying Morphology, Taxonomy, and Dendrology. In 2024, the University President issued an executive order declaring the site an Ecopark, recognizing it as an ecologically important area. It comprises 23.5 hectares, and the trail has a length of 1.2 kilometres (11). The study aims to inventory and classify ethnobotanically significant plant species within ECOTRIS, which will serve as a repository for future sustainable development. Research on ethnobotany in Ifugao is minimal, with several studies focusing on different ethnolinguistic groups. Regarding ethnobotanical conservation, no records of projects are available to conserve and protect these ethnobotanically significant plant species. Therefore, this study is being conducted so that future generations can still see and appreciate the forest and its ethnobotanical importance.

Materials and Methods

Study area

The ECOTRIS is located within the Ifugao State University Potia Campus in Alfonso Lista, Ifugao, Philippines (Fig. 1A-1C). The Department of Forestry manages it under the College of Agriculture and Sustainable Development. Regarding the conservation approach, the site functions as both an *ex-situ* and *in-situ* conservation area. This means it protects native trees in their natural habitat (*in-situ*) and

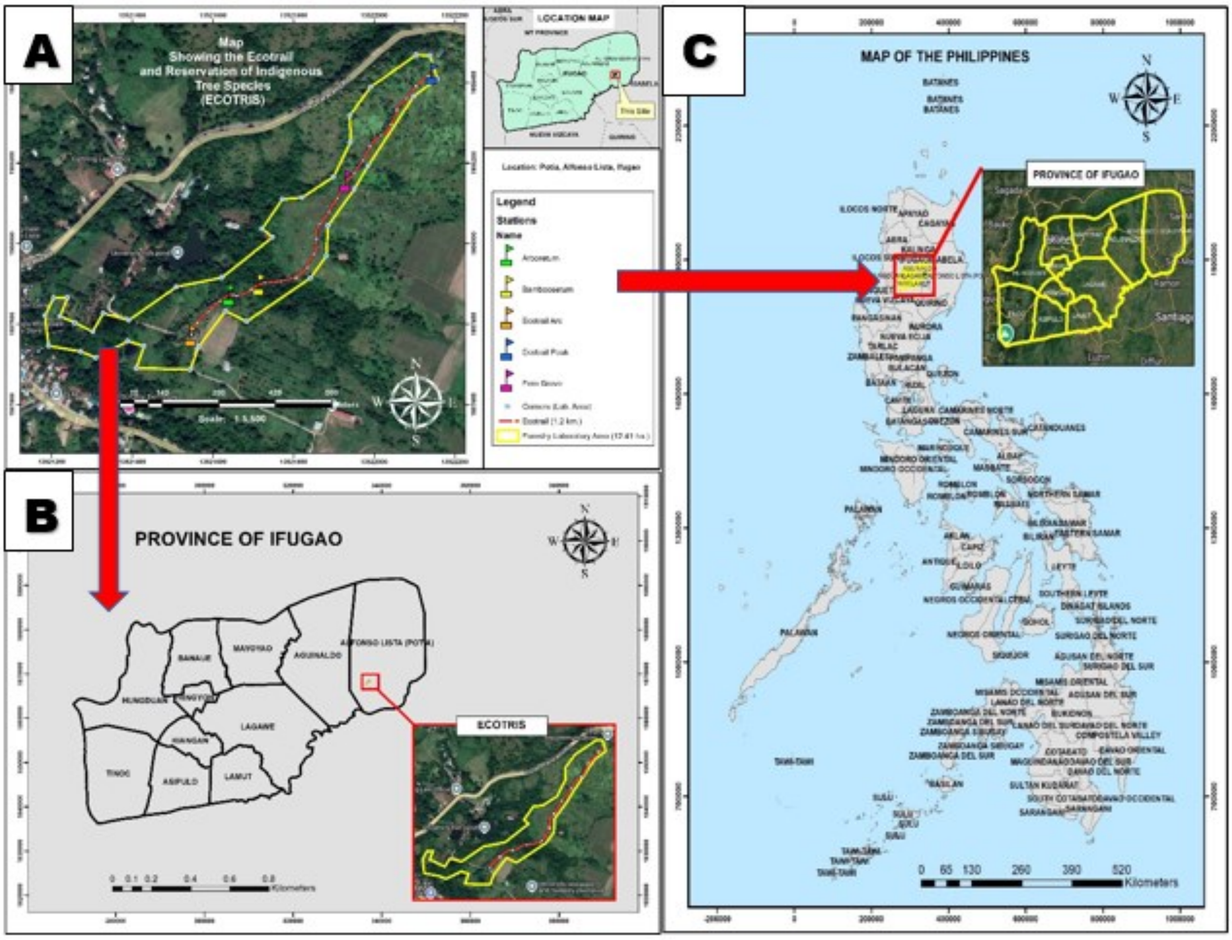

Fig. 1. (A) The study site ecological trail and reservation site of indigenous species (ECOTRIS) in the (B) Ifugao province (C) Philippines.

houses a collection of trees planted outside their natural environment (*ex-situ*). The significance of this site is the ECOTRIS is home to a variety of native trees with high endemism, meaning many of these species are unique to the region. The trees also hold ethnobotanical significance, reflecting their traditional uses by local communities. With sustainable practices, the site is actively managed using silvicultural practices like weeding, pruning, salvage cutting, and integrated pest management to ensure the health and sustainability of the tree populations. The study area is not within the ancestral domain, and the text notes that ECOTRIS is not located within a formally recognized ancestral domain. This detail is significant because it suggests that obtaining free prior informed consent (FPIC) from Indigenous communities, a crucial ethical consideration for research involving traditional knowledge and resources, was not deemed necessary in this context.

Methods for macro floral survey

A plot with a measurement of 20×100 m was laid out. 3 20m × 20m quadrants and 3 5m × 5m sub-quadrants per quadrant for the catalogue of trees, shrubs and vascular plants. The density, frequency, dominance, species richness and diversity were measured using the following formula and methods established and described, including the species importance value (SIV) computation from Equation 1-6 (12).

$$\textbf{Density (D)} = \frac{\text{No. of Individuals}}{\text{Area Sampled}} \quad \text{(Eqn. 1.)}$$

$$\textbf{Relative density (RD)} = \frac{\text{(D) of Plot 1}}{\text{Total density of all species}} \times 100 \quad \text{(Eqn. 2.)}$$

$$\textbf{Frequency (F)} = \frac{\text{(D) of Plot 1}}{\text{Total density of all species}} \times 100 \quad \text{(Eqn. 3.)}$$

$$\textbf{Relative frequency (RF)} = \frac{\text{(D) of Plot 1}}{\text{Total density of all species}} \times 100 \quad \text{(Eqn. 4.)}$$

$$\textbf{Dominance (Dom)} = \frac{\text{Species basal coverage values}}{\text{Area sampled}} \quad \text{(Eqn. 5.)}$$

*Note: The basal areas of trees were taken at breast height level (1.5 m above ground), while measurements for small trees/shrubs were taken at 10 cm above the ground.

$$\textbf{Relative dominance (RDOm)} = \frac{\text{Dominance of species}}{\text{Total dominance of all species}} \times 100 \quad \text{(Eqn. 6.)}$$

Species importance value (SIV)

As a rough and overall estimate of the influence or importance of plant species in the community, the SIV might be helpful and were computed by the following formula as in Equation 7:

$$\textbf{SIV} = RD + RF + RDom \quad \text{(Eqn. 7.)}$$

Where, RD = Relative density, RF = Relative frequency, and RDom = Relative dominance

Species diversity indices

The Importance Value of Species A and total IV of all species were computed. The Importance Value of Species A and total IV of all species were calculated to obtain Species Diversity using the Shannon index of general diversity (H')as given in equation 8:

$$\mathbf{H'} = -\sum \frac{ni\ \log\ ni}{N} \quad \text{(Eqn. 8.)}$$

Where ni = total number of individuals per species;
N = total number of individuals of all species

The similarity index was computed using the unweighted Pair Group Method using averages (UPGMA), which shall be used in the data analysis (13).

Ethnobotanical plant identification and classification

The study used previously conducted research data; hence, the researchers relied on data from a prior ethnobotanical study titled "Strengthening Philippine Institutional Capacity to Adopt Climate Change (SPICACC)" as a starting point for their inventory of ethnobotanical trees (13). Validation was conducted online by cross-referencing the identified plant species with various online resources, including the "Cos' Digital Flora of the Philippines" platform (14) and other relevant literature. This approach ensured the accuracy of their plant identifications. Drawing on their expertise, the researcher utilized their knowledge and experience as a registered Forester, Environmental Planner, and Ayangan, Ifugao indigenous group member. This first-hand understanding of local flora further strengthened the validity of their findings. Essentially, the researchers employed a multi-pronged method to ensure the accuracy and reliability of their ethnobotanical data, integrating existing research, online resources, and local expertise.

Data Analysis

The identified ethnobotanical data were gathered, tallied and tabulated, then subjected to statistical analysis and interpretation. Frequency, similarity and diversity indices were used through counts and percentages to analyze the responses descriptively. Identified trees were catalogued by local name, common name, family name, ethnobotanical significance, and other uses. Graphs and figures were generated from the analyzed data. The reading on its latitude and longitude were converted into a data set, and then a Geographic Information System (GIS) was employed to manipulate data and create overlay maps. At the same time, the Global Positioning System (GPS) was used to geotag the corner of the plot location. Georeferenced data, including land use and tributaries, were reflected in the maps.

Results

The study area was divided into four land-use compartments (Fig. 1). The first was the arboretum, where native trees were located. These trees were either naturally grown or planted. Within the arboretum, there were clusters of forest stands, including Narra (*Pterocarpus indicus* Willd.), Molave (*Vitex parviflora* Juss.), Ipil (*Intsia bijuga* Colebr.), Banaba (*Lagerstroemia speciosa* (L.) Pers.), Sablot (*Litsea glutinosa* (Lour.) C.B.Rob.), Kalantas (*Toona calantas* Merr.), Dao (*Dracontomelon dao* Blanco), and many others. The Department of Environment and Natural Resources (DENR) classified the first three species as premium and endangered. The second compartment was the bamboo setum, a bamboo plantation with various species, primarily Bolo (*Gigantochloa levis* Blanco), alongside golden bamboo (*Phyllostachys aurea* Carrière), Buddha bamboo (*Bambusa pervariabilis* McClure), black bamboo (*Phyllostachys nigra* Lodd.), and Kawayan Tinik (*Bambusa spinosa* L.). The third compartment was the fern grove, where ferns and other species thrived in wetland areas were found. The final compartment was the peak area with the highest elevation on the site. The surrounding areas were grasslands dominated by cogon (*Imperata cylindrica* L.).

Biodiversity indices of the ECOTRIS

Three plots were established near water tributaries: the first was at the lower stream, the second at midstream, and the third at the upper stream. The second plot exhibited the highest diversity index (3.02), followed by the third plot (2.78) and the first plot (2.56) (Table 1). This higher diversity in the midstream area was likely attributed to the dense canopy strata formed by clustered forest stands. In contrast, the third plot was located near a marginal area, acting as a buffer between agricultural zones, such as corn plantations. Plot 2 had the highest species richness, followed by Plot 3, with Plot 1 having the least. Plot 2 consistently showed the highest biodiversity across various metrics (species richness, Shannon Index, Simpson Index, and Berger-Parker Index), with the largest population, while Plot 3 had the smallest. Plot 1 appeared to have the least biodiversity, exhibiting the highest dominance of its most abundant species and the lowest evenness. Plot 2 had the highest Shannon diversity index and evenness, indicating a more even species distribution. Plot 1 and 3 were similar in evenness and diversity but remained lower than Plot 2. Plot 3 tended to fall between Plots 1 and 2 in most metrics. A map showing the georeferences of the plots (Fig. 2) established in the low, mid, and upper tributaries indicated that the blue line represented the stream networks. Plot 2 again demonstrated the highest diversity, followed by Plot 3, with Plot 1 having the least diversity.

Table 1. Biodiversity indices in the different plots inside the ECOTRIS

Indicators	Plot 1	Plot 2	Plot 3
No. of Species (S)	68	81	71
Total No. of Individuals	980	1112	679
Shannons' index			
$H'_{observed}$	2.56	3.02	2.78
H'_{max}	4.12	4.31	4.22
Eveness	0.7	0.8	0.70
Simpsons' Index			
Λ	0.041	0.032	0.030
$1 / \lambda$	20.161	26.306	23.871
$1 - \lambda$	0.931	0.95	0.94
Berger-parker			
Most Abudant (Nmax)	102	98	81
Berger-Parker Index	0.112	0.06	0.07
1 / Berger-Parker Index	8.010	12.28	11.001

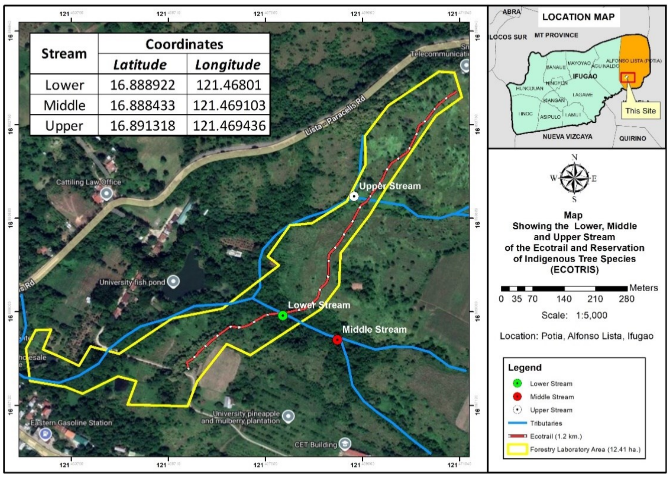

Fig. 2. Map showing the georeferences of the plots established in low-mid-upper tributaries, the blue line is the stream networks.

Similarity indices of vascular plants found inside the ECOTRIS

The similarity indices presented in Table 2 revealed that plot 1 had the highest similarity index (0.601), likely due to the dense forest stand and a multi-layered tree canopy in the area. Plot 3 had the lowest similarity index, followed by plot 2, both of which are located in the buffer zone between forested and agricultural land (Fig. 2). The proximity of ECOTRIS to residential areas has led to human-induced activities, such as wildlife hunting/ trapping, timber cutting, firewood collection, and the gathering of aquatic snails. These activities disturb the sites' biodiversity. Plot 1 and 2 have a higher degree of similarity in species composition, suggesting they share more species in common than either does with Plot 3. Plots 1 and 3 and plots 2 and 3 show moderate similarity, indicating that while there is some overlap in species, these plots have more distinct species compositions than the relationship between plots 1 and 2. All plots show low similarity based on species abundance, with plots 2 and 3 showing the highest degree of similarity in species distribution. Plot 1 has notably low similarity in species abundance compared to Plot 2 and Plot 3. The Jaccard measure indicates that plots 1 and 2 share many species, whereas the other plot pairs share fewer species. The Morisita-Horn measure shows that, despite shared species, the abundance of species between the plots is quite different, particularly between Plot 1 and the other two.

Table 2. Percent similarity matrix among different plots inside the ECOTRIS

Plot	Jaccard measure (qualitative data)		
	Plot 1	Plot 2	Plot 3
Plot 1	0.601	0.329	0.431
Plot 2	0.031	0.901	0.316
Plot 3	0.0119	0.213	0.810
	Morisita- Horn measure (quantitative data)		

Species Importance Value (SIV) of trees found inside the ECOTRIS

The Species Importance Value (SIV) is dependent on the number of trees in each sampling area (density), as well as the summation of Relative Density (RD), Relative Frequency (RF), and Relative Dominance (RDom) of each species, which are derived from the diameter measurements of each species. As observed in this survey, the low SIV shown in Fig. 3 can be attributed to the limited number of large bole diameter trees in the sampling plots, resulting in low relative dominance. The highest-ranking species, with an SIV close to 10 or above, include *Melanolepis multiglandulosa* Merr., *Macaranga tanarius* L. and *Streblus asper* Lour. These species likely play a dominant role in the ecosystem because they are highly abundant, have large biomass, or are widely distributed. Species with SIV values between roughly 6 and 8, such as *Ficus pseudopalma* Blanco and *Ficus septica* Burm.f., are still crucial in the ecosystem but are less dominant than the top species. While species on the lower end of the chart, such as *Parkia javanica* Skeels., have SIV values closer to 3 or below. These species are likely less dominant

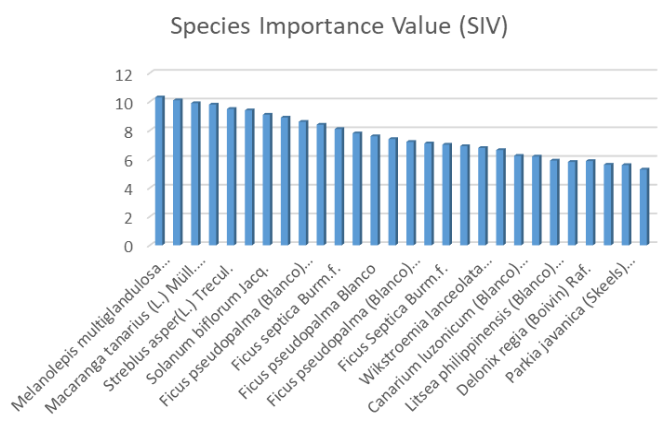

Fig. 3. Species importance value of vascular plant found inside the ECOTRIS.

or less abundant but may still play niche roles within the ecosystem.

Species with higher SIV values, such as *Melanolepis multiglandulosa* Merr. and *Macaranga tanarius* L. could be key drivers of ecosystem processes. Their high values may indicate that they are crucial in providing resources (e.g., food, habitat) or maintaining the structure and function of the ecosystem. The species with lower SIV values may be more specialized or less abundant, playing smaller but potentially essential roles in certain ecosystem functions or interactions with other species. Most of the vascular plants found in the sampling plots were in the sapling stage or slightly more prominent, with very few individuals having diameters greater than 30 cm. The highest Species Importance Value (SIV) was recorded for Binunga (*Melanolepis multiglandulosa* Merr.) at 10.9, likely due to the sites' history as a logged-over area, now dominated by pioneering species. This was followed by *Macaranga bicolor*, while the lowest SIV was recorded for *Syzygium sp*. (5.37). Given that the site is a degraded area, pioneering species from the Moraceae and Euphorbiaceae families tend to dominate and colonize the barren or degraded forest environment. Narra, locally known as "Udyo" (*Pterocarpus indicus Willd*), had an SIV of 7.2. Indigenous cultural communities widely recognize it for its medicinal properties in treating various illnesses.

The study revealed that 22 species serve as food sources, ranging from fruits to stems (Table 3). While these fruits are edible, caution is advised, as some contain toxic compounds. Relative frequency refers to the number of times a plant species occurs in the established plots. Alim (*Macaranga tanarius* L.) exhibited the highest relative frequency, followed by Tibig (*Ficus nota* Blanco) and *Antidesma pentandrum* Blanco. The lowest relative frequency was recorded for *Anona reticulata* L. This can be attributed to the fact that the site is marginal land dominated by pioneering species, except for Bangkal, located in the wetland areas of ECOTRIS. Species like *Macaranga tanarius. L* and *Ficus nota* Blanco with high RF also show high SIV values, suggesting species frequently encountered in the study area dominate ecosystem functions. Species such as *D. philippinensis* with lower RF values tend to have lower SIV scores, indicating their lesser impact on the ecosystem structure. While RF is a good indicator of a species' importance, other variables like biomass or ecological roles are likely to refine the SIV scores further. For example, a species with moderate RF could still rank higher or lower in SIV, depending on its broader ecological contribution.

The study revealed 35 ethnobotanically significant tree species (Table 4). Molave (*Vitex parviflora* Juss) recorded the highest importance value at 2.41, followed by Alim (*Melanolepis multiglandulosa* Merr.) and Hauili (*Ficus septica* Burm.f.) with values of 2.28 and 3.21, respectively. Relative density refers to the number of trees per sampling area. The indigenous cultural communities in Ifugao believe that these vascular plants, primarily native trees, possess potential curative effects for various health conditions. Species with both high RF and RD, like *Melanolepis multiglandulosa* Merr. consistently rank high in SIV. This confirms that frequent and abundant species

Table 3. Lists of vascular plants used as food documented in the ecological trail and reservation site of indigenous species (ECOTRIS)

Common name	Local name	Family name	Scientific name	Part of the tree	Relative frequency (RF)
Alim	Alem	Euphorbiaceae	*Macaranga tanarius* L.	Fruit	3.41
Tibig	Tebbeg	Moraceae	*Ficus nota* Blanco	Fruit	3.21
Binayuyu	Arusip	Phyllantaceae	*Antidesma pentandrum* Blanco.	Fruit	1.87
Bamban	Bamban	Marantaceae	*Donax canniformis* Forst.	Fruit	1.16
Tuai	Tuwol	Phyllantaceae	*Bischofia javanica* Blume.	Fruit	0.91
Bignay	Bugnay	Phyllantaceae	*Antidesma bunius* L.	Fruit	0.86
Coffee	Kape	Rubiaceae	*Coffea arabica* L.	Fruit	0.83
Bunga	Moma	Arecaeae	*Areca cathecu* L.	Fruit	0.68
Wild grapes	Ariwat	Vitaceae	*Vitis flextosa* Thunb.	Fruit	0.59
Rambutan	Rambutan	Sapindaceae	*Nephelium lappaceum* L.	Fruit	0.52
Kalumpit	Kala-otet	Combretaceae	*Terminalia microcarpa* Hance	Fruit	0.46
Calamansi	Kalamansi	Rutaceae	*Citrofortunella microcarpa* Bunge	Fruit	0.46
Limuran	Lituko	Arecaeae	*Calamus Manillensis* Blanco.	Fruit/ Stem	0.37
Katmon	Ukapon	Dilleniaceae	*Dillenia philippinensis* A. Gray	Fruit	0.32
Bangkoro	Apatot	Rubiaceae	*Morinda citrifolia* L.	Fruit	0.30
Lanzones	Lansones	Meliaceae	*Lansium domesticum* Corr.	Fruit	0.31
Kamagong	Mabolo	Ebenaceae	*Diosphyrus philipensis* Merr.	Fruit	0.22
Antipolo	Pakak	Moraceae	*Artocarpus blancoi* Merr.	Fruit	0.18
Datiles	Aratiles	Muntingiaceae	*Multingia calabura* L.	Fruit	0.13
Anonas	Anonat	Annonaceae	*Anona reticulata* L.	Fruit	0.12
Bangkal	Bulala	Rubiaceae	*Nauclea orientalis* L.	Fruit	0.10

are key contributors to ecosystem function. Species with a moderate SIV despite high RF because their RD is relatively low, meaning that abundance (density) also influences their ecological importance beyond frequency. Species like *Ficus nota* Blanco. which show moderate RD but still have a high SIV, demonstrating that RD can significantly affect a species' overall ecological role. Table 4 further revealed that *Melanolepis multiglandulosa* Merrs' high RF and RD consistently rank high in species importance value (SIV), highlighting its frequent and abundant presence in the ecosystem as a key contributor to ecological functions. Conversely, despite high RF, species with moderate SIV may have lower RD, suggesting that their abundance, or lack thereof, influences their environmental role. For instance, *although showing moderate RD, Ficus nota Blanco* retains a high SIV, demonstrating that RD significantly contributes to a species' overall ecological importance. This finding supports the idea that species' abundance (density) and frequency are essential factors in understanding their environmental and ethnobotanical significance within the region.

Discussion

The study provides an overview of the status of vascular plants found within the Ecological Trail and Reservation Site of Indigenous Trees, located at the Ifugao State University, Potia Campus, Alfonso Lista, Ifugao. The study area has high potential as a repository for ethnobotanically significant species. Although the floral diversity is not exceptionally high, likely due to its history as a logged-over forest, sustainable management and conservation efforts could transform it into a local biodiversity hotspot. This research revealed that the indigenous cultural communities of Ifugao have customarily used various native tree species as medicines for food and multiple illnesses, a finding supported by numerous studies at both international and local levels. Traditional medicine is an indispensable component of Ifugao healthcare, with knowledge of medicinal plants passed down through generations via old traditions (15). The locality is home to abundant medicinal plant species, and the floral diversity contributes to the ecosystems' service value, the ECOTRIS itself a fraction of the mountainous region. This is confirmed (16), who noted that traditional medicinal plants are a foremost component of indigenous medical systems worldwide (17). These practices are conveyed through actual practice by various cultural communities, including using Narra, locally known as "Udyo" (*Pterocarpus indicus* Willd.). Indigenous people of Ifugao utilize this tree for different medical applications and established its use in customary

Table 4. List of vascular plants used as a remedy for various common illnesses also used for culture and construction found inside the ECOTRIS

Common name	Local name	Scientific name	Family name	Relative density (RD)
Mamalis	Poh-wi	*Pittosporum pentandrum* Blanco	Pittosporaceae	1.72
Anabiong	Anaciong	*Trema orientalis* L.	Cannabaceae	0.98
Binunga	Samak	*Macaranga tanarius* L.	Euphobiaceae	0.77
Daing-daing	Rafe	*Ficus botryocarpa* Miq.	Moraceae	1.61
Kalios	Akikid	*Streblus asper* L.	Moraceae	1.69
Alagaw	Atingol	*Premna odorata Blanco* Blanco.	Lamiaceae	0.18
Bagan-bagan	Bagan-bagan	*Solanum biflorum* Jacq.	Solanaceae	0.09
Narra	Udyo	*Pterocarpus indicus* Willd.	Fabaceae	0.35
Niog-niogan	Niog-niogan	*Ficus pseudopalma* Blanco	Moraceae	0.36
Tuai	Tuwol	*Bischofia javanica* Blume.	Phyllanthaceae	1.46
Hauili	Liwliw	*Ficus septica* Burm.f.	Moraceae	1.59
Banato	Anitap (bl)	*Mallotus Philippinensis* L.	Euporbiaceae	1.61
Alim	Alem	*Melanolepis multiglandulosa* Merr.	Euphorbiaceae	2.41
Antipolo	Pakak	*Artocarpus communis* Forst.	Moraceae	0.44
Niog-niogan	Niog-niogan	*Ficus pseudopalma* Blanco	Moraceae	0.13
Tan-ag	Pukag	*Kleinhovia hospita* L.	Malvaceae	0.19
Hauili	Haguili	*Ficus septica* Burm.f.	Moraceae	2.28
Banato	Anitap (bl)	*Mallotus Philippinensis* L.	Euphobiaceae	1.18
Salagong sibat	Hu-a	*Wikstroemia lanceolata* Siebold & Zucc.	Thymelaeaceae	0.17
Anabiong	Anaciong	*Trema orientalis* L.	Cannabaceae	2.33
Pagsahingin bulog	N/a	*Canarium luzonicum* Blanco	Burseraceae	0.77
Alahan/Salab	N/a	*Guioa koelreuteria* L.	Sapindaceae	0.91
Bakan	N/a	*Litsea philippinensis* Blanco	Lauraceae	0.73
Anubing	N/a	*Artocarpus ovatus* Blanco.	Moraceae	1.63
Fire tree	N/a	*Delonix regia* Boivin	Fabaceae,	0.69
Golden shower	N/a	*Cassia fistula* L.	Fabaceae,	0.13
Kupang	N/a	*Parkia javanica* Skeels	Fabaceae	0.19
Molave	N/a	*Vitex parviflora* Juss.	Lamiaceae	3.21
Kalantas	N/a	*Toona calantas* Merr.	Meliaceae	1.37
Palawan cherry	N/a	*Cassia nodosa* L.	Fabaceae	0.38
Igyo	N/a	*Dysoxylum decandrum* Blanco	Meliaceae	1.49
Sablot	N/a	*Litsea glutinosa* Lour.	Lauraceae	1.59
Pandakaki	N/a	*Tabernaemontana pandacaqui* Blanco.	Apocynaceae	0.65
Paguringon	N/a	*Cratoxylum sumatranum* Jack	Hypericaceae	1.01
Kamagong	N/a	*Diospyros philippinensis* Merr.	Ebenaceae	0.03

*N/a=local name not known

medicine for treating inflammatory diseases, gonorrhoea, infections, coughs, mouth ulcers, boils, diarrhoea, and painkillers (18).

The Bangkal (*Nauclea orientalis* L.) fruit contains various bioactive compounds, including tannins, alkaloids, flavonoids, saponins, phytates, cyanogenic glycosides, phosphates, anthraquinones, coumarin, monoterpenes, and fatty acid esters (19). Several of these compounds have beneficial effects on human health. For instance, the extract from Tibig (*Ficus nota* Blanco) exhibits both antioxidant and pro-oxidant properties, depending on the concentration used (20). In Ifugao, indigenous people utilize Bangkal (*Nauclea orientalis* L.) by pounding 1 to 2 shoots and applying the ensuing paste directly as a poultice on wounds, changing it every 24 hours. A strapping is used to hold the poultice in place (SPICACC). This plant is rich in phytochemicals with recognized therapeutic properties, including antimicrobial, anti-nociceptive, and anti-inflammatory effects (21). Medicinal fruits as adjunct therapy show promise for treating acute and chronic diseases. However, the role of these fruits remains unexplored mainly (22). Bangkoro, also known as Noni (*Morinda citrifolia* L.), has high nutritional value and may induce therapeutic effects, including antimicrobial and antioxidant properties (23). Some of these edible fruits found inside the ECOTRIS is Antipolo (*Artocarpus blancoi* Merr. The bark extract decoction is employed in traditional medicine to treat "Strangularia" (hernia), while the Ayta community in Pampanga uses the leaves and fruits as food (24, 25). Ongoing research is crucial to fully understand the medical potential of these fruits (26).

Several illnesses can be treated using simple processes such as pounding and crushing leaves, which are applied to wounds or used to alleviate internal ailments. For instance, *Pterocarpus indicus* Willd., locally known as "Udyo," is utilized by drying the trees' stem, pounding it into a fine powder, and applying it to wounds to minimize bleeding. Additionally, the Ifugao province has a remarkable ethnobotanical history, being home to indigenous people with diverse ethnolinguistic backgrounds and socio-cultural traditions that have influenced their nutritional practices over time. One example of cultural use is Salagong sibat (*Wikstroemia lanceolata* Siebold & Zucc.), locally known as "Hu-a" (Punhib-at), which is a wooden stick used to beat gongs during cultural events (26). Local people also identified Kalaotit (*Terminalia microcarpa* Hance.) as a food source in the community for a long time. Numerous species within the *Terminalia* genus are used in herbal medicine and preparations for the treatment of various diseases, including headaches, fever, pneumonia, flu, geriatric ailments, cancer, memory improvement, abdominal and back pain, coughs and colds, conjunctivitis, diarrhoea, heart disorders, leprosy, sexually transmitted diseases, and urinary tract disorders (27). Customarily, fruits containing phytochemicals are consumed as food and medicine due to their health benefits (28).

Interestingly, little is known about the ethnobotany of Bagan-bagan (*Solanum biflorum* Jacq.). Although several international studies have been conducted on this plant, as with other varieties of Solanaceae, local research focusing on its ethnobotanical uses is very limited, if not entirely lacking. Species within the *Solanum* spp genus have been extensively used in folk medicine to treat various human ailments since the early beginning of civilization (29). The local community has long believed Bagan-bagan (*Solanum biflorum* Jacq.) can cure toothaches. Usually, local people would use a small bamboo branch as a straw to direct the smoke from burning the fruit to the aching tooth. However, with the advent of modern medicine, this traditional knowledge has faded into history. This study aims to showcase the ECOTRIS as a knowledge repository, ensuring that future generations can access and utilize this valuable conventional and indigenous wisdom. Moreover, it will contribute to ecosystem remediation efforts, strengthening site-specific Indigenous knowledge and systems by the local communitys' including its practices (30).

The family of Solanaceae have been found on various continents due to their Neotropical origin (31, 32). The largest genus within this family comprises over 1,250 species, making it both economically and culturally significant for its food crops (33, 34). The indigenous people of Ifugao have used kalios (*Streblus asper* L.) as a medicinal plant since immemorial (35). It has established therapeutic potential in various parts of the world. Thorough pharmacological investigations have shown that *S. asper* exhibits anti-inflammatory, antioxidant, antimicrobial, antibiofilm, and anticancer activities (36). The wild grapes fruits, *Vitis flexuosa* Thunb. is a food source; however, its fruit can bite taste buds when eaten in large quantities. It is an economically important species, prompting exploration of its wild genetic resources (37). This wild vine grape, native to other countries, can also be found in the Philippines. Other ethnobotanical studies in the country have highlighted its efficacy against wounds (9, 38) and for treating cuts, coughs, and diabetes (39).

It is worth mentioning that the Datiles (*Muntingia calabura* L.) plant is usually used to alleviate pain from gastric ulcers (40). Narra, locally known as "Udyo" (*Pterocarpus indicus Willd*), is well-known among indigenous cultural communities for its medicinal properties. Multiple studies have validated that similar outcomes have been noted in the country (41, 42). Most of the remedies were prepared by drinking the decoctions. This tree is the national tree of the Philippines and is classified as endangered by the Department of Environment and Natural Resources. Regarding cultural uses of vascular plants, Binunga (*Macaranga tanarius* L.) is employed by the Ifugao during the "dallung" rites, a ceremony performed to heal a sick person believed to be possessed by an evil spirit. The hagimit (*Ficus minahasae* Miq.) has its sap extracted from the bark and is used to capture birds, a practice referred to as "pukot" by the Ifugao (42). Many horticultural species are challenging or even impossible to preserve as seeds due to their production of recalcitrant seeds or their reliance on vegetative reproduction. Therefore, these species should be maintained as living plants in field gene banks like (43) this ECOTRIS. Despite the challenges of maintaining field genebanks, they offer convenient and immediate access to preserved materials for research and practical applications. Furthermore, alternative preservation methods are not yet fully developed for many plant species, making field gene banking the most suitable option (43).

The study conducted inside the Ecological Trail and Reservation Site of Indigenous Trees (ECOTRIS) illustrates the region's first exploration of ethnobotanical conservation. Its exceptional landscape where forest stands are classified based on their health-related importance, reflecting the diverse knowledge of the indigenous cultural communities of Ifugao. This knowledge has been passed down through generations and generations to come. It is deeply rooted in their history. The study's main finding is the successful establishment of the Ecological Trail and Reservation Site of Indigenous Trees as a future field gene bank for ethnobotanical trees. This site is a living gene bank of ethnobotanical forest resources, contributing to sustainable development. Although the area is currently dominated by pioneering vascular plants, indicating its status as a logged-over forest, the site possesses moderate to low macrofloral diversity. With enrichment planting and the introduction of more native trees, it has the potential to serve as a future field gene bank or *ex-situ* collection, primarily consisting of forest tree species sourced from in situ trees in the nearby mountains. Indigenous practices for tree conservation will also be integrated into the site, creating an intriguing ecological forest park that functions as both a botanical garden and an ethnobotanical repository.

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Authors' Contributions

The author is the sole contributor to the study.

Compliance with Ethical Standards

Conflict of interest: Authors do not have any conflict of interest to declare.

Ethical issues: None

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