

Ethnobotany and floristic diversity of aquatic flora as traditional uses and conservation concerns in West Sumatran lakes, Indonesia

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Abstract. Syamsuardi, Christy P, Nurainas, Audina Z, Chairul, Ritonga MA. 2026. Ethnobotany and floristic diversity of aquatic flora as traditional uses and conservation concerns in West Sumatran lakes, Indonesia. *Asian J Ethnobiol* 9 (1): y090111. <https://doi.org/10.13057/asianjethnobiol/y090111>. West Sumatra, Indonesia, hosts numerous lakes that support diverse aquatic resources central to local daily activities. Both natural origins and long-term anthropogenic influences shape the composition of aquatic flora. Increasing pollutant inputs, however, threaten the persistence of these plant species and the traditional knowledge associated with them. This study aims to examine the floristic diversity of lake hydrophytes and their ethnobotanical roles to support sustainable utilization. Ethnobotanical surveys were conducted in seven *nagari* representing seven lake systems across the districts of Agam, Tanah Datar, Solok, and South Solok. Data were collected from August to November 2024 using semi-structured interviews involving 393 randomly selected respondents. Information on traditional uses and knowledge of aquatic flora was recorded, while plant specimens were collected and identified at the ANDA Herbarium, Universitas Andalas. A total of 16 aquatic plant species from 12 families were recorded, with species richness varying among lakes. *Polygonum barbatum* occurred in all lakes, while *Panicum auritum* was present in most locations. The highest Relative Frequency of Citation (RFC) values were recorded for *Eichhornia crassipes* (0.47). The highest Informant Consensus Factor (ICF) occurred in agriculture and handicrafts (1.00). The greatest Use Value (UV; 0.078) was observed for *Elymus fluitans* and *P. auritum*. These findings demonstrate the close relationship between floral diversity and ethnobotanical knowledge in lake ecosystems and highlight the need to integrate local knowledge into conservation planning. The results of this study provide a scientific basis for developing sustainable lake conservation and management strategies that simultaneously protect aquatic plant diversity, maintain traditional knowledge, and mitigate increasing anthropogenic pressures on freshwater ecosystems.

Keywords: Ethnobotany, floristic diversity, hydrophytes, lake, West Sumatra

Abbreviations: ANDA: Universitas Andalas Herbarium, EKI: Ethnobotanical Knowledge Indeks, FC: Frequency of Citation, ICF: Informant Consensus Factor, N: Total number of respondents, Nur: Number of Use Reports, Nt: Number of species used in each category, RFC: Relative Frequency of Citation, UV: Use Value

INTRODUCTION

The Indonesian island of Sumatra lies along the equator and is characterized by high rainfall and a complex geological history, resulting in diverse freshwater ecosystems with high biological productivity (Muhtadi et al. 2023; Delrieu-Triottin et al. 2025). West Sumatra, in particular, has numerous lakes formed through volcanic activity, tectonic movements, and hydrological processes such as river sedimentation (De Maisonneuve et al. 2019; Lukman et al. 2020; Wils et al. 2021). Large lakes, including Maninjau, Singkarak, Diatas, Dibawah, and Talang, as well as several smaller and less well-documented lakes, play a crucial role as freshwater ecosystem services (Christy et al. 2023a). These lakes regulate hydrological and chemical cycles, support aquatic and semi-aquatic biodiversity, and contribute to landscape-level ecological stability. For local communities, lakes are

important socio-ecological systems that provide clean water, fishery resources, and livelihoods through capture fisheries and floating cage aquaculture (Sunanisari et al. 2008; Simmance et al. 2022; Nyamweya et al. 2023; Bhattacharya et al. 2024; Schiemer et al. 2024; Xue et al. 2024). However, increasing dependence on lake resources has exacerbated anthropogenic pressures, including nutrient enrichment, pollution, and physical disturbance. These pressures directly impact water quality and influence the structure, composition, and sustainability of aquatic flora communities, which are fundamental to freshwater ecosystem function.

Despite their ecological and economic significance, complete and integrated data on aquatic plant diversity in West Sumatran lakes are scarce. The enormous number of lakes spread across various topographical and biological environments has limited systematic floristic surveys and long-term monitoring (Sender et al. 2021; Staniszewski et

al. 2024). Existing research typically focuses on particular lakes or specific ecological factors, resulting in a fragmented understanding of hydrophyte species, distribution patterns, and community organization at the regional scale. As a result, the entire potential of West Sumatran lakes as sites of aquatic plant variety has not been completely explored. Preliminary evidence from herbarium records and subsequent floristic investigations confirmed the existence of the Sumatran endemic *Potamogeton sumatranus*, showing that these lakes provide specialized habitats for regionally limited aquatic plant species (Solfiyeni et al. 2022b; Christy et al. 2023a, b; Tanjung et al. 2024). The presence of endemic taxa underlines the great conservation value of these lake habitats, emphasizing the importance of conducting integrated floristic surveys. However, these findings have yet to be consolidated across different lake systems, limiting their applicability to regional conservation planning and sustainable lake management.

In addition to their ecological function, lakes in West Sumatra are important ethnobiologically as well as ecologically. Aquatic plants have long been used by neighboring populations for food, medical uses, animal feed, handicrafts, and other daily necessities (Zhang et al. 2014; Deka et al. 2019; Arya et al. 2022). Long-term engagement with lake ecosystems has resulted in knowledge of plant identity, harvesting techniques, and specific uses, which have been passed down orally between generations. This ethnobotanical knowledge is an important part of the local cultural legacy and helps to ensure the sustainable use of freshwater resources. The survival of ethnobotanical knowledge is inextricably tied to ecological stability and the continuous presence of aquatic plant species. Increased anthropogenic disturbances can change hydrophyte community structure and lower species diversity (Elo et al. 2018; Florescu et al. 2024; Wu et al. 2025). Such ecological changes jeopardize not only ecosystem functions but also the survival of traditional knowledge systems based on specific plant species (Huda et al. 2022; Solfiyeni et al. 2022a). As aquatic plant populations decline or disappear, associated knowledge and cultural practices may also erode, weakening the

relationship between local communities and lake ecosystems.

Based on these conditions, the purpose of this study is to characterize the floristic diversity of aquatic plants in West Sumatran lakes and investigate their ethnobotanical applications using an integrated floristic-ethnobotanical method. This study addresses current information gaps by studying many lake systems from various districts, providing a regional perspective on hydrophyte variety and usage. The combination of floristic inventory and ethnobotanical study enables a more complete understanding of the relationships between lake ecological parameters, aquatic plant diversity, and community-based knowledge systems. This study is unique in that it uses a cross-lake and integrative framework to uncover wider patterns of aquatic plant diversity and ethnobotanical usage in West Sumatra, rather than single-site studies. The findings are likely to provide a scientific foundation for freshwater biodiversity conservation, inform sustainable lake and water resource management, and help maintain ethnobotanical knowledge, which is essential for culturally grounded and sustainable resource use. Accordingly, this study hypothesizes that lakes with more stable environmental conditions support higher aquatic plant diversity, and that more widely distributed and readily available species have greater ethnobotanical importance and knowledge retention among local communities.

MATERIALS AND METHODS

Study area

This research was conducted in several lake locations, Lake Diatas, Dibawah, Talang, Tuo, Singkarak, Maninjau, and Bontak in West Sumatra, Indonesia, at four districts, namely Agam, Tanah Datar, Solok, and South Solok. The research location is shown in Figure 1. The interview location, number of respondents, and environmental characteristics of each lake are presented in Table 1. The field survey was conducted from August to November 2024. This includes collecting ethnobotanical data, taking aquatic flora specimens, and recording lake environmental variables.

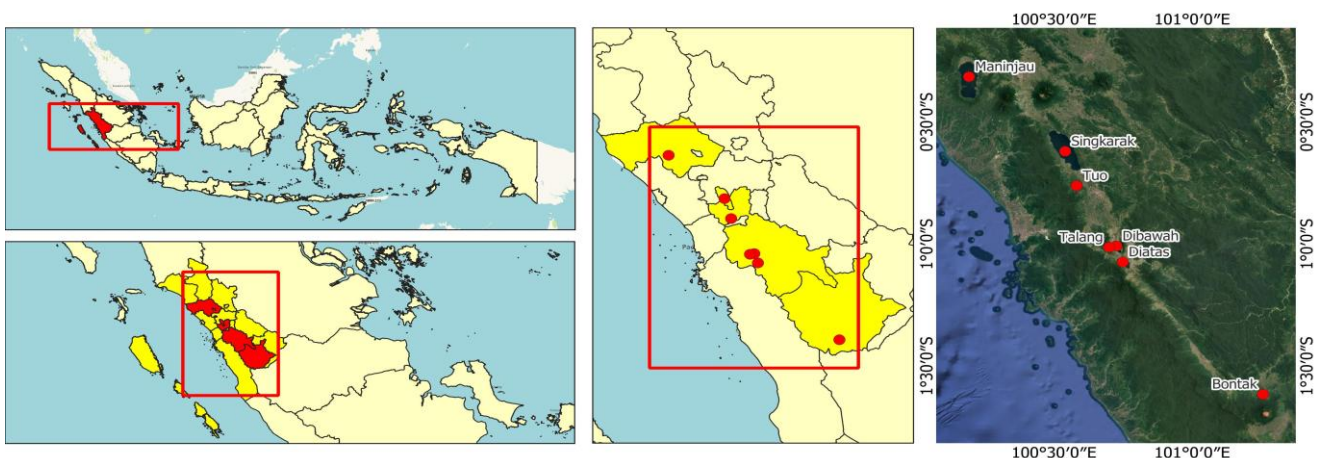


Figure 1. Map of the study area, lakes in West Sumatra, Indonesia

Table 1. Description of selected villages in study area and ecological description of the lake

Lake(s)	pH	COD	Temperature	Elevation	Sub district/ Village	No. of Population	No. of Households	No. of Respondents
Maninjau	7.19	4.75	29.80	459	Tanjung Raya/ Maninjau	3,492	1,130	19
Singkarak	7.27	5.44	28.85	362	X Koto/Singkarak	4,879	1,527	26
Diatas	7.27	4.82	22.90	1,531	Lembah Gumanti/ Alahan Panjang	20,628	6,101	105
Dibawah	7.17	4.23	23.38	1,462	Danau Kembar/ Kampung Batu Dalam	10,992	3,099	53
Bontak	5.87	1.89	26.48	1,210	Sangir/ Lubuk Gadang	18,832	5,274	94
Tuo	7.28	5.03	28.18	775	X Koto/ Koto Sani	3,406	2,500	43
Talang	7.25	4.73	22.38	1,674	Danau Kembar/ Kampung Batu Dalam	10,992	3,099	53
					Total	73,221	22,730	393

The environmental variables recorded include temperature, pH, organic matter content (COD), and elevation. These parameters are used to describe the physical and chemical conditions of waters that influence the distribution and diversity of aquatic flora, analyzed to support the interpretation of hydrophyte distribution patterns and the level of their utilization by the community. Identification and data analysis of the lake's aquatic flora will be carried out at the ANDA Herbarium, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Andalas, Padang, West Sumatra.

Procedures

Ethnobotanical surveys

The sample size for ethnobotanical respondents was determined using the Cochran sample size formula as described by Barlett et al. (2001).

$$n = \frac{N}{1 + N(e)^2}$$

Where, n = research sample size, N = total number of households in all selected research locations (22,730), and e is the margin of error set at 5% (0.05) with a 95% confidence level and assumed proportion of 0.5.

Based on this calculation, a total of 393 respondents were included in this study. Respondents were selected using simple random sampling from household lists within the lake's administrative area surrounding each lake, with the number of respondents per lake allocated proportionally to the number of households at each location (Table 1). Ethnobotanical data were collected through semi-structured questionnaires and field observations. Inclusion criteria included permanent residence in the area for at least five years, age ≥ 15 years, and willingness to participate. Temporary residents and individuals with insufficient residence duration were excluded. Demographic characteristics of respondents, which are relevant for interpreting patterns of ethnobotanical knowledge distribution, are summarized in Table 2. All plant specimens collected during the study were identified and deposited at the Andalas Herbarium (ANDA).

Data analysis

Data were analyzed using Relative Frequency of Citation (RFC), informant consensus factor, use value, and ethnobotanical knowledge index. Ethnobotanical data were organized using Microsoft Excel spreadsheets. Ethnobotanical data were analyzed using quantitative indices after standardizing use reports. Each use report was defined as a unique mention of a species associated with a single use category by a single informant. Repeated mentions of the same use by the same informant were counted once, while different uses of the same species were recorded as separate reports. This approach aimed to maintain data consistency and avoid bias due to information repetition (Dapar et al. 2020; Motti et al. 2023; Mahdi et al. 2025).

Relative Frequency of Citation (RFC) is used to measure the relative importance of a species based on the proportion of informants who mention it, while Use Value (UV) reflects the diversity of uses of a species based on the total number of uses reported. The Informant Consensus Factor (ICF) is calculated for each use category to assess the level of community agreement, with high values indicating concentrated use of a few species by many informants (Cornara et al. 2009; Polat et al. 2015; Albuquerque et al. 2020).

The ethnobotanical data are evaluated using the formula RFC Index (Vitalini et al. 2013):

$$RFC = \frac{FC}{N}$$

Where, FC is the frequency citation, and N is the total number of respondents participating in the study.

The informant consensus factor is calculated for each category to identify the community consensus regarding aquatic flora species utilization (Cornara et al. 2014):

$$ICF = (Nur - Nt) / Nur - 1$$

Where, Nur is the number of use plants for each category. Nt is the total number of species used for each category.

Table 2. Socio-demographic characteristics of the respondent

Characteristics	Study area						
	Maninjau	Singkarak	Tuo	Talang	Diatas	Dibawah	Bontak
Gender							
Male	8	12	18	21	54	27	51
Female	11	14	25	32	51	26	43
Age							
5-15	0	1	0	6	6	3	12
16-25	0	0	0	0	1	1	14
26-35	3	9	14	14	14	10	18
36-45	3	5	6	21	24	17	18
46-55	7	5	13	5	27	13	16
56-65	5	4	6	3	30	7	13
66-75	1	2	4	4	3	2	3
Latest education							
Elementary School	2	4	7	11	29	9	15
Junior High school	10	9	12	22	38	15	44
Senior High school	7	10	24	19	37	28	32
Higher Education	0	3	0	1	1	1	3

The use value represents the number of utilizations, evaluated by formula (Polat et al. 2015):

$$UV = \frac{U}{N}$$

Where, U is the total number of uses mentioned by informants for a species and N is the total number of informants interviewed.

The Ethnobotanical Knowledge Index (EKI) is used to assess an individual's level of ethnobotanical knowledge based on the proportion of their knowledge score to the maximum possible score. Each respondent is given a score between 0 and 6 for each aspect of ethnobotanical knowledge, with higher scores indicating a deeper understanding of plant species and their uses. This index represents the extent of respondents' knowledge of species diversity and their uses. Therefore, variations in EKI scores between individuals or groups can be used as an indicator of traditional knowledge retention and the potential erosion of ethnobotanical knowledge within a community (De Beer and Van Wyk 2011; Reyes-Garcia et al. 2015; Quinlan et al. 2016). The EKI formula measures informants' ethnobotanical knowledge at a certain location. The EKI was evaluated by formula (De Beer and Van Wyk 2011):

$$EKI = \frac{\text{Sum of all species score from a particular respondent}}{\text{maximum score}}$$

Where, EKI is the ethnobotanical knowledge index, it represents the indigenous knowledge of all plant species in the study area. Chi-square and Kruskal-Wallis tests were used to compare indigenous knowledge, age, gender, and education level. PAST 4.03 software was used for the statistical analysis.

The use of the RFC, UV, ICF, and EKI indices provides a complementary picture of the importance of aquatic plants, their utilization patterns, and the state of traditional community knowledge. The RFC and UV indicate the most well-known and most widely utilized species, thus being considered to have high cultural and economic value and potentially experiencing utilization pressure. The ICF illustrates the level of community agreement within each

utilization category, reflecting how robust and widespread knowledge about the utilization of these plants is within the community. Meanwhile, the EKI assesses the level of ethnobotanical knowledge at the individual level, allowing for the identification of differences in knowledge across age groups, gender, and education levels. By integrating these four indices, the study not only assesses the ethnobotanical importance of species but also reveals the potential erosion of traditional knowledge and its implications for conservation efforts and the sustainability of aquatic plant resources.

RESULTS AND DISCUSSION

Aquatic flora diversity in West Sumatra lakes

Based on surveys conducted in several lakes in West Sumatra, namely Lakes Diatas, Dibawah, Talang, Tuo, Bontak, Maninjau, and Singkarak, there is a variety of aquatic flora that is different in each lake (Table 3). Based on the results of an inventory of aquatic plants in seven lakes, a number of species belonging to several families were recorded, with variations in composition between lakes. Lake Diatas has the highest species richness, with a total of 11 species from 10 families: Alismataceae, Asteraceae, Balsaminaceae, Ceratophyllaceae, Cyperaceae, Hydrocharitaceae, Poaceae, Polygonaceae, Pontederiaceae, and Potamogetonaceae. The Cyperaceae family is represented in this lake by two species: *Actinoscirpus grossus* and *Scirpus mucronatus*. Lake Dibawah recorded 11 species from eight families. The Poaceae family is the family with the largest number of species in this lake, consisting of *Leersia hexandra*, *Leptochloa* sp., and *Panicum auritum*. Other species are distributed across the families Araceae, Asteraceae, Balsaminaceae, Cyperaceae, Hydrocharitaceae, Polygonaceae, Pontederiaceae, and Potamogetonaceae. Lake Singkarak has 9 species belonging to 8 families. The Hydrocharitaceae family is represented in this lake by two species: *Hydrilla verticillata* and *Najas marina*, while the other families are represented

by one species each. Lake Tuo shows a lower number of species, with 4 species from 4 families: Asteraceae, Cyperaceae, Poaceae, and Polygonaceae. Lake Maninjau has 5 species from 4 families, with the Hydrocharitaceae family represented by two species: *Hydrilla verticillata* and *N. marina*. Lake Bontak has the fewest species, with 2 species from 2 families: *Scirpus mucronatus* (Cyperaceae) and *Polygonum barbatum* (Polygonaceae). Lake Talang has 3 species from 2 families: Poaceae and Polygonaceae. The Poaceae family is represented in this lake by two species: *L. hexandra* and *P. auritum*. Overall, *P. barbatum* was found in all lakes, and *P. auritum* was found in almost all lakes, while some other species were only found in certain lakes.

The diversity of aquatic plants in lakes varies significantly and is directly tied to the ecological circumstances of each body of water. Lake Diatas and Lake Dibawah have the highest family and species variety compared to other lakes. This is likely due to neutral pH levels ($\pm 7.17-7.28$), somewhat cooler temperatures ($\pm 22-23^{\circ}\text{C}$), and moderate COD values. These conditions generate a somewhat stable aquatic habitat that supports the growth of several types of aerial plants, such as submerged, floating, and emergent plants. The physicochemical stability of the waters is known to play an essential role in enhancing biodiversity and allowing various aerial macrophyte species to coexist (Lahon and Sahariah 2022; Buenano and Zueva 2023). Lakes Singkarak and Maninjau have a fairly diverse number of species, tending to be dominated by certain species such as *Eichhornia crassipes* and *H. verticillata*. Higher COD values and warmer water temperatures ($\pm 28-30^{\circ}\text{C}$) indicate more fertile or eutrophic water conditions. Eutrophication and increased temperatures together increase the growth of certain aerial plant species or may encourage the dominance of species that are tolerant of high nutrients and grow rapidly (Zhang et al. 2020). Lakes with the lowest levels, such as Lake Bontak, exhibit stronger environmental barriers. In Lake Bontak, the relatively acidic pH (± 5.87) is a major barrier for many aquatic plants, as the aquatic habitat can affect nutrient availability and plant physiological processes. Environmental physicochemical factors act as environmental filters that determine the composition of the aerial plant community; only species with specific tolerances or adaptations are able to survive. Strong environmental constraints can limit the species that can survive, thus affecting the diversity of the community structure (Havens and Jeppesen 2018; O'Hare et al. 2018). Overall, differences in plant diversity between lakes in this data are primarily influenced by the interaction of physicochemical factors such as pH, temperature, and COD, which in turn influence water fertility and interspecific competition. Changes in lake environmental conditions, whether due to natural processes or anthropogenic activities, will be directly reflected in the structure and composition of aquatic plant communities (O'Hare et al. 2018; Zhang et al. 2020).

Based on ethnobotanical records of aquatic plants in several lakes, a number of species have been identified that are utilized by local communities for various purposes. A

total of 16 species of aquatic flora from 12 families were recorded (Table 4). Poaceae was the most dominant family with 3 species (18.75%), followed by Cyperaceae with 2 species (12.5%) and Hydrocharitaceae with 2 species (12.5%). Other families are represented by one species each.

Table 3. Comparison of aquatic flora diversity among lakes in West Sumatra, Indonesia

Lake(s)	Family	Species
Diatas	Alismataceae	<i>Limnocharis flava</i> (L.) Buchenau
	Asteraceae	<i>Enydra fluctuans</i> Lour.
	Balsaminaceae	<i>Impatiens</i> sp.
	Ceratophyllaceae	<i>Ceratophyllum demersum</i> L.
	Cyperaceae	<i>Actinoscirpus grossus</i> (L.f.) Goetgh. & D.A.Simpson
		<i>Scirpus mucronatus</i> (L.)
	Hydrocharitaceae	<i>Hydrilla verticillata</i> (L.f.) Royle
	Poaceae	<i>Panicum auritum</i> J.Presl ex Nees
	Polygonaceae	<i>Polygonum barbatum</i> L.
	Pontederiaceae	<i>Eichhornia crassipes</i> (Mart.) Solms
Potamogetonaceae	<i>Potamogeton sumatranus</i> Miq.	
Dibawah	Araceae	<i>Pistia stratiotes</i> L.
	Asteraceae	<i>Enydra fluctuans</i> Lour.
	Balsaminaceae	<i>Impatiens</i> sp.
	Cyperaceae	<i>Actinoscirpus grossus</i> (L.f.) Goetgh. & D.A.Simpson
		<i>Hydrilla verticillata</i> (L.f.) Royle
	Hydrocharitaceae	<i>Hydrilla verticillata</i> (L.f.) Royle
	Poaceae	<i>Leersia hexandra</i> Sw. <i>Leptochloa</i> sp. <i>Panicum auritum</i> J.Presl ex Nees
	Polygonaceae	<i>Polygonum barbatum</i> L.
	Pontederiaceae	<i>Eichhornia crassipes</i> (Mart.) Solms
	Potamogetonaceae	<i>Potamogeton sumatranus</i> Miq.
Araceae	<i>Pistia stratiotes</i> L.	
Singkarak	Asteraceae	<i>Enydra fluctuans</i> Lour.
	Convolvulaceae	<i>Ipomoea aquatica</i> Forssk.
	Hydrocharitaceae	<i>Hydrilla verticillata</i> (L.f.) Royle
		<i>Najas marina</i> L.
	Poaceae	<i>Panicum auritum</i> J.Presl ex Nees
	Polygonaceae	<i>Polygonum barbatum</i> L.
	Pontederiaceae	<i>Eichhornia crassipes</i> (Mart.) Solms
Potamogetonaceae	<i>Potamogeton sumatranus</i> Miq.	
Tuo	Asteraceae	<i>Enydra fluctuans</i> Lour.
	Cyperaceae	<i>Actinoscirpus grossus</i> (L.f.) Goetgh. & D.A.Simpson
	Poaceae	<i>Panicum auritum</i> J.Presl ex Nees
Maninjau	Polygonaceae	<i>Polygonum barbatum</i> L.
	Convolvulaceae	<i>Ipomoea aquatica</i> Forssk.
	Hydrocharitaceae	<i>Hydrilla verticillata</i> (L.f.) Royle
		<i>Najas marina</i> L.
	Polygonaceae	<i>Polygonum barbatum</i> L.
Pontederiaceae	<i>Eichhornia crassipes</i> (Mart.) Solms	
Bontak	Cyperaceae	<i>Scirpus mucronatus</i> (L.)
	Polygonaceae	<i>Polygonum barbatum</i> L.
Talang	Poaceae	<i>Leersia hexandra</i> Sw. <i>Panicum auritum</i> J.Presl ex Nees
	Polygonaceae	<i>Polygonum barbatum</i> L.

Table 4. Aquatic flora of the lake in West Sumatra, Indonesia, and its potential uses

Family, scientific name	Specimen codes	Local name	Habit	Plant part used	Categories	Use (s)	Lake (s)	Reference
Alismataceae <i>Limncharis flava</i> (L.) Buchenau	DA.2-13	Genjer	Herb	Leaf	Food	Vegetable	DA	Christy et al. (2023b)
Araceae <i>Pistia stratiotes</i> L.	DB.1-18	Kiambang	Herb	All	Ornamental	Pool decoration	DB, DS	Hasan and Chakrabarti (2009), Christy et al. (2023b)
Asteraceae <i>Enydra fluctuans</i> Lour.	DTu.2-14	Cikarau	Herb	Leaf	Medicine Food	Concoction Salad	DA, DB, DTu, DS	Stark et al. (2016), Arifin et al. (2018), Christy et al. (2023b)
Balsaminaceae <i>Impatiens</i> sp.	DB.2-38	Inai aia	Herb	Leaf	Medicine	Pain-killer	DA, DB	Delgado-Rodriguez et al. (2023)
Ceratophyllaceae <i>Ceratophyllum demersum</i> L.	DA.2-7	Ganggang	Herb	All	Ecological function	Fish spawning	DA	Hasan and Chakrabarti (2009)
Convolvulaceae <i>Ipomoea aquatica</i> Forssk.	DTu.1-37	Kangkung	Herb	Leaf	Food	Vegetable	DS, DM	Hasan and Chakrabarti (2009); Christy et al. (2023b)
Cyperaceae <i>Actinoscirpus grossus</i> (L.f.) Goetgh. & D.A.Simpson	DA.1-8	Mansiang	Herb	Leaf	Handicraft	Woven material	DA, DB, DTu	Tajkia et al. (2018), Christy et al. (2023b)
<i>Scirpus mucronatus</i> (L.)	DBo.1-9	Mendong	Herb	Leaf	Handicraft	Woven material	DA, DBo	Hasan and Chakrabarti (2009), Christy et al. (2023b)
Hydrocharitaceae <i>Hydrilla verticillata</i> (L.f.) Royle	DM.1-5	Ganggang, Jariamun Sagu	Herb	All	Ornamental	Pool decoration	DA, DB, DS, DM	Hasan and Chakrabarti (2009), Christy et al. (2023b)
<i>Najas marina</i> L.	DS.1-34	Jariamun Sagu	Herb	All	Ornamental	Pool decoration	DS, DM	Hasan and Chakrabarti (2009)
Poaceae <i>Leersia hexandra</i> Sw.	DT.1-20	Rumpuik Banto	Herb	Leaf	Medicine	Concoction	DB, DT	Bilanda et al. (2019)
<i>Leptochloa</i> sp.	DB.2-22	Caramantiang	Herb	Fruit	Medicine	Concoction	DB	Nurlaha et al. (2014)
<i>Panicum auritum</i> J.Presl ex Nees	DS.1-35	Cikumpai	Herb	Leaf	Medicine	Concoction	DA, DB, DT, DTu, DS	Adlan and Setiawan (2023)
Polygonaceae <i>Polygonum barbatum</i> L.	DB.1-12	Lado-lado	Herb	Leaf	Medicine	Pain-killer	DA, DB, DT, DTu, DS, DM, DBo	Burkill (1966), Nurlaha et al. (2014), Adlan and Setiawan (2023)
Pontederiaceae <i>Eichhornia crassipes</i> (Mart.) Solms	DB.1-2	Kalayau, Eceng gondok	Herb	All All All Leaf Leaf All All	Medicine Ornamental Ecological function Food Handicraft Fodder Agricultural	Extract Pool decoration Fish spawning Vegetable Woven material Duck feed Compost	DA, DB, DS, DM	Hasan and Chakrabarti (2009), Christy et al. (2023b), Mangare et al. (2025)
Potamogetonaceae <i>Potamogeton</i>	DS.1-6	Jariamun	Herb	All	Ornamental	Pool	DA, DB,	Hasan and Chakrabarti

<i>sumatranus</i> Miq.	decoration	DS	(2009), Christy et al. (2023b)
	Ecological function	Fish spawning	
	Fodder	Buffalo feed	
	Agricultural	Scarecrow material	

Note: Lake(s): DA: Lake Diatas, DB: Lake Dibawah, DT: Lake Talang, DTu: Lake Tuo, DS: Lake Singkarak, DM: Lake Maninjau, DBo: Lake Bontak

The most common uses of aquatic plants include food, medicine, crafts, ornamental plants, animal feed, agriculture, and ecological functions. Plant parts utilized include leaves, the entire plant, fruit, and, in some cases, other specific parts. Within the food category, several species are used as vegetables or salads, including *Limnocharis flava*, *Enydra fluctuans*, *Ipomoea aquatica*, and *E. crassipes*. The plant part used in this category is generally the leaves. The medicinal plant category includes species such as *E. fluctuans*, *Impatiens* sp., *L. hexandra*, *Leptochloa* sp., *P. auritum*, *P. barbatum*, and *E. crassipes*. Medicinal plants are used in the form of decoctions, extracts, or as pain relievers, with the leaves and whole plants being the most commonly used plant parts. In the crafts category, species from the Cyperaceae and Pontederiaceae families are used as weaving materials. *Actinoscirpus grossus*, *S. mucronatus*, and *E. crassipes* are species used primarily for their leaves or whole plants. The ornamental plant category is dominated by floating and submerged species such as *Pistia stratiotes*, *H. verticillata*, *N. marina*, *E. crassipes*, and *P. sumatranus*, which are commonly used for pond decoration. Several species also have ecological functions, particularly as fish spawning grounds, including *Ceratophyllum demersum*, *H. verticillata*, *E. crassipes*, and *P. sumatranus*. Furthermore, *E. crassipes* and *P. sumatranus* have been noted to have diverse uses, including as livestock feed (for ducks and buffalo), agricultural materials (compost and scarecrows), and craft and food materials.

The lake environment is characterized by permanently stagnant waters, water-saturated sediments, and anaerobic conditions in the bottom layer, which physiologically support the growth of hydrophytic herbaceous plants with aerenchyma tissue and shallow root systems. In line with these conditions, in this study, only herbaceous plant species were found. These adaptations allow for effective gas exchange and nutrient absorption in muddy substrates, while woody plants generally require better soil aeration and high substrate stability, making it difficult to thrive in open lake habitats (O'Hare et al. 2018; Vukov et al. 2026). Some of the species reported to be more commonly found include *H. verticillata*, *P. sumatranus*, *E. crassipes*, and several types of grass (Sunanisari 2008; Christy et al. 2023b). Local people tend to use plants that are easy to find, abundant, and located around their homes because the availability of raw materials is relatively high. This is consistent with the findings of Syamsuardi et al. (2022) and Suwardi et al. (2023). It argues that the usage of these plants is based on the ease of access to raw materials as well as their properties in supporting traditional medicine,

the knowledge of which is passed down through generations.

Aquatic plants found in various lakes play an important role in freshwater biodiversity, encompassing ecological, economic, food, and health functions. *Genjer* (*L. flava*) is an aquatic herb commonly used as a traditional vegetable in Southeast Asia, particularly in Indonesia, Thailand, and Malaysia. Its leaves and young shoots are consumed for their nutritional content, while its ability to absorb excess nutrients such as phosphate makes it a potential phytoremediation tool for maintaining air quality (Hui et al. 2017; Zakaria et al. 2023; Rambe et al. 2024). *Pistia stratiotes* (*kiambang*), a floating plant from the Araceae family, is known as an ornamental plant and has potential in controlling eutrophication through the absorption of heavy metals and nutrients. Its use as animal feed has been reported to be limited in some parts of Asia, but direct human consumption requires caution due to the risk of contaminant accumulation (Tamer et al. 2025). Meanwhile, *cikarau* (*E. fluctuans*) is consumed as a fresh vegetable and is reported to have pharmacological activities, such as antioxidant and anti-inflammatory, as shown in ethnobotanical studies related to its traditional uses, phytochemical content, and nutritional value (Barua et al. 2020).

Other species, such as *A. grossus*, *Najas* sp., and *S. mucronatus*, although rarely reported in food or medical contexts, have economic value as raw materials for weaving, a practice long practiced by communities around the lake. This reflects the diverse uses of aquatic plants beyond the food and health sectors. Ecologically, *C. demersum* plays an important role as a fish spawning habitat and a substrate for aquatic biota communities, emphasizing the crucial role of submerged vegetation in aquatic ecosystem dynamics. Some aquatic plants, such as *E. crassipes* (*eceng gondok*) and *P. sumatranus*, exhibit multifunctional properties, including as traditional medicines, handicrafts, food, decoration, and animal feed. According to Bakrim et al. (2022), *E. crassipes* is used in traditional medicine as well as a potential source of bioenergy, biofertilizer, and phytoremediation agent to control organic and inorganic pollutants through accumulation and degradation mechanisms. Overall, aquatic vegetation contributes significantly to aquatic ecosystem function, local food security, traditional medicinal practices, and craft-based economic activities. Local culture and traditional knowledge play a key role in the utilization, management, and conservation of aquatic plants. Local knowledge, including collection habits, food processing techniques, traditional medicinal practices, and

wisdom in plant selection and harvesting, facilitates the sustainable use of aquatic resources and maintains the continuity of ecosystem functions and associated cultural services. This strengthens local food security and maintains socio-cultural values tied to aquatic landscapes (Elwell et al. 2020; Panyadee et al. 2022).

Cultural use patterns

Local communities residing along the lake's shores tend to utilize aquatic plants that are abundant and easily accessible near their settlements. Analysis of the Relative Frequency of Citation (RFC) index revealed significant differences in the recognition and use of aquatic flora by these communities. A high RFC value indicates a species that is widely known and frequently used at the study site (Figure 2). The index value varies between species, with a range of values between 0.05 and 0.47. The species with the highest index value is *E. crassipes* (0.47), followed by *P. auritum* (0.40). The index value for *E. fluctuans* was recorded at 0.31, while *H. verticillata* had a value of 0.29. Medium index values were also shown by *P. sumatranus* (0.24) and *P. barbatum* (0.21). Meanwhile, *A. grossus* had an index value of 0.10, and the lowest value was recorded for *C. demersum* at 0.05.

The high citation value indicates that *E. crassipes* is the most familiar aquatic plant among the lake's residents. This condition is thought to be related to its ecological dominance as a highly adaptive invasive species with broad potential for use. Furthermore, *E. crassipes* is easily recognized and obtained because it grows floating freely in large groups in lake waters. Harun et al. (2021) stated that water hyacinth is an aquatic plant commonly found floating in groups along almost all lake shores. The presence of settlements around lakes can increase water fertility (eutrophication), which in turn encourages an increase in the population of water hyacinth and other aquatic weeds. Two types of lake aquatic flora with RFC values below *E. crassipes*, namely *E. fluctuans* (*cikarau*) and *P. auritum* (*cikumpai*), are the plants most often used as traditional medicine. These two species are commonly used in traditional Minangkabau medicine along with two other

plants, namely *sitawa* and *sidingin*. Stark et al. (2016) and Arifin et al. (2018) reported that *cikarau*, *cikumpai*, *sitawa*, and *sidingin* are the main components of traditional Minangkabau medicinal concoctions. This healing practice is known as *tawa nan ampel* or *ureh nan ampek* and is generally performed by village shamans to treat fever (*keteguran*) and various other ailments. In contrast, *C. demersum* had the lowest RFC value (0.05), indicating that knowledge and utilization of this aquatic plant is limited to a small number of informants. Species with low RFC values require conservation attention, as low levels of public recognition can potentially lead to the species being overlooked, despite their ecological role or potential uses. Therefore, RFC serves not only as an ethnobotanical indicator but also as an initial diagnostic tool in determining research priorities and managing lake biodiversity.

The category with the most reports by locals for its utilization was medicine (7 species). Other categories are followed by ornamental plants (5 species), ecological functions (4 species), food (4 species), handicraft (3 species), and categories such as fodder and agriculture with 2 species for each. Informant Consensus Factor (ICF) values vary from 0.33 to 1.00 (Table 5). The highest ICF value (ICF=1.00) was for the agricultural and handicraft category, indicating the most consistent utilization of aquatic flora in the study area (Ritonga et al. 2023), while medicine (ICF=0.67 to 0.90), fodder (ICF=0.80), and others below (ICF≤0.75).

Some aquatic flora, including weeds and invasive plants, often pose problems in water bodies such as lakes (Christy et al. 2023b; Di Lernia et al. 2025; El-Alfy et al. 2025). However, local communities utilize these plants effectively, in accordance with their local wisdom (Norkum et al. 2025). For example, the population explosion of *E. crassipes* in Lakes Singkarak and Maninjau, which was initially detrimental, is now utilized for handicrafts along with other species such as *A. grossus* and *S. mucronatus*, thus becoming a source of local income (Mangare et al. 2025).

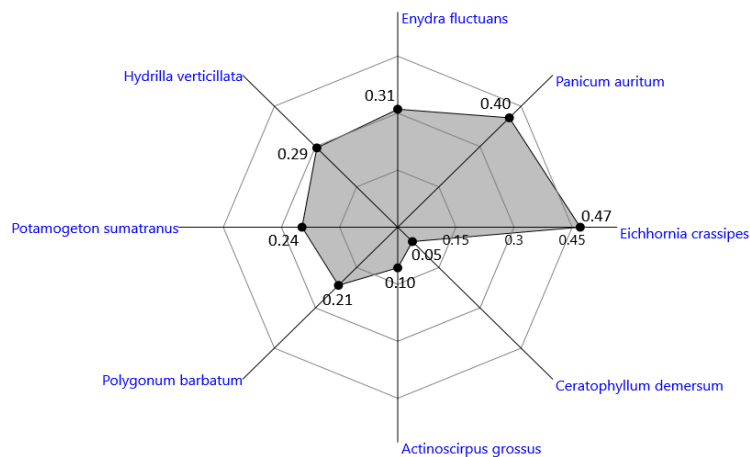


Figure 2. Relative Frequency of Citation (RFC) of aquatic flora

An ICF of 1.00 for the agriculture and handicrafts category indicates that all relevant informants agree on the specific function of the plant. This reflects the homogeneity of knowledge and practices within the user group, despite the relatively limited number of species (Tounekti et al. 2019; Lulesa et al. 2025). This may be because categories directly related to community livelihoods and specialized skills, such as plant use for agriculture or handicrafts, are generally mastered by local practitioners or experts who regularly interact with the plants in their economic context. Frequent encounters with relevant plants and reliance on their functions increase experience, skill, and consistency of use among informants, resulting in high ICF values. Thus, plant categories with strong functional links to production activities and livelihoods tend to exhibit high levels of consensus because their knowledge and practices are intensively transmitted by local communities.

Medicinal purposes of lake aquatic flora

Based on data on the use of aquatic plants as traditional medicine, seven species are recorded as being used to treat various ailments (Table 6). The most commonly used part of the plant is the leaf, while other parts used include the fruit. Methods of processing medicinal plants vary, including extraction, crushing, steeping, boiling (decoction), and mixing with other ingredients. Some species are used without additives, while others are mixed with additional ingredients such as *ureh nan ampek*, chicken eggs, surian bark, and pandan roots. The route of drug administration is oral, external application, or a

combination of both. Oral use is the most frequently reported route. *Eichhornia crassipes* is used using the leaves without additives, processed through extraction, and administered orally for traditional medicine. *E. fluctuans* uses leaves mixed with *ureh nan ampek*, processed by mixing, and used through external and oral applications to treat fever, stomach ulcers (*ureh*), and diarrhea. *Impatiens* sp. is used using the leaves without additives, processed by crushing, and applied externally to treat eye pain. *L. hexandra* uses leaves soaked in chicken eggs and consumed orally to treat fever. *Leptochloa* sp. uses fruit without additional ingredients, processed by soaking, and consumed orally to treat stomach aches. *P. auritum* uses leaves mixed with *ureh nan ampek*, processed by mixing, and used orally or externally to treat fever, burning sensation, stomach ulcers (*ureh*), and diarrhea. *P. barbatum* uses leaves boiled with surian bark and pandan roots, used orally by gargling to treat toothache.

Referring to Christy et al. (2023b), and Suwardi et al. (2023), the categories of ethnobotanical utilization can be divided into medicines, food, ornamental plants, crafts, animal feed, agricultural tools, and ecological functions. A total of 7 species (43.75%) of aquatic flora were used for traditional medicine by local people who live near the lake's shores in West Sumatra (Table 6). These species were used to treat various human ailments. Two species of aquatic flora, namely *E. fluctuans* and *P. auritum*, are the plants most often used as Minangkabau traditional medicine.

Table 5. Informant consensus factor of use categories

Categories	No. of use(s)	No. of species used	ICF						
			DB	DA	DT	DS	DM	DTu	DBo
Provisioning									
Food	12	4	0.67	0.75	0.00	0.50	0.00	0.00	0.00
Medicine	64	7	0.76	0.82	0.71	0.67	0.00	0.90	0.00
Fodder	6	2	0.00	0.00	0.00	0.80	0.00	0.00	0.00
Agricultural	8	2	1.00	0.00	0.00	1.00	0.00	0.00	0.00
Regulating									
Ecological function	10	4	0.00	0.33	0.00	0.50	0.50	0.00	0.00
Cultural									
Ornamental	9	5	0.00	0.00	0.00	0.62	0.00	0.00	0.00
Handicraft	44	3	1.00	0.00	0.00	1.00	1.00	1.00	1.00

Note: Lake(s): DA: Lake Diatas, DB: Lake Dibawah, DT: Lake Talang, DTu: Lake Tuo, DS: Lake Singkarak, DM: Lake Maninjau, DBo: Lake Bontak

Table 6. List of aquatic flora for traditional medicine

Scientific name	Plant part used	Additional ingredients	Mode of preparation	Route of administration	Disease treated
<i>Eichhornia crassipes</i> (Mart.) Solms	Leaf	none	Extract	Oral	Traditional herbal
<i>Elydra fluctuans</i> Lour.	Leaf	Along with <i>ureh nan ampek</i>	Mixed	External application, oral	Fever, heartburn (<i>ureh</i>), <i>keteguran</i>
<i>Impatiens</i> sp.	Leaf	none	Crushing	External application	Sore eyes
<i>Leersia hexandra</i> Sw.	Leaf	Chicken egg	Steeped	Oral	Fever
<i>Leptochloa</i> sp.	Fruit	none	Steeped	Oral	Stomachache
<i>Panicum auritum</i> J.Presl ex Nees	Leaf	Along with <i>ureh nan ampek</i>	Mixed	External application, oral	Fever, burning up, heartburn (<i>ureh</i>), <i>keteguran</i>
<i>Polygonum barbatum</i> L.	Leaf	Surian bark, pandan root	Decoction	Oral (gargle)	Toothache

The Use Value (UV) of traditional medicine aquatic flora varies between species, with a range of values between 0.002 and 0.078 (Figure 4). The highest UV values were recorded in *P. auritum* and *E. fluctuans*, with values of around 0.078. Medium UV values were shown by *P. barbatum* at 0.035 and *Impatiens* sp. at 0.030. Furthermore, *L. hexandra* had a lower UV value, at around 0.015. The lowest UV values were recorded in *Leptochloa* sp. and *E. crassipes*, with values of around 0.005 and 0.002, respectively.

Among seven species for traditional medicine, 2 species were the most used and important by local people in the study area. This plant is used along with other plants in *ureh nan ampek*, a Minangkabau ethnopharmacological practice still practiced alongside modern medical services. This concept emphasizes bodily balance through a combination of four medicinal plants as the core of a concoction to address health disorders understood by local communities based on the dichotomy of heat and cold and the balance of the body's energy, in line with the humoral principles of other traditional medical systems such as Ayurveda and Chinese Yin Yang. Anthropological research indicates that this knowledge was passed down orally by traditional ecological healers, through observation of plants and symbolic associations between cultural narratives and the plants' biological properties such as flavonoids, steroids, and saponins which are believed to function as "heat suppressants" or "cold suppressants" according to local disease categories such as *ureh*, *karabu*, and digestive disorders (Tresno et al. 2025).

The role of traditional healers in indigenous communities extends beyond the use of plants, serving as knowledge mediators who integrate biological, social, and spiritual aspects into the healing process. These practices include diagnosis based on inherited experiences, the selection of plants appropriate to specific conditions, and the preparation of herbal remedies, both oral and topical,

all grounded in a cultural understanding of disease as an imbalance in the relationship between humans and their physical and non-physical environments. Modern ethnobotanical studies in Indonesia indicate that various ethnic groups utilize a diversity of local plants to address health concerns, with leaves often being the primary ingredient in herbal remedies due to their empirical association with therapeutic effectiveness and ease of daily use (Fadhilah et al. 2023; Tahoangako et al. 2024).

An ethnobotanical analysis of the plants included in *ureh nan ampek* shows that each component has a complementary functional role within the local cultural framework. The addition of other ingredients to some concoctions reflects the integration of traditional bioenergetic and nutritional elements viewed as strengthening the body. This pattern of use confirms the continuity of complex local knowledge, adapting to social and ecological changes, and maintaining the cultural relevance of *ureh nan ampek* in the daily lives of modern Minangkabau communities (Tresno et al. 2025). Meanwhile, other species such as *H. verticillata*, *P. sumatranus*, *P. barbatum*, *A. grossus*, *Impatiens* sp., *L. hexandra*, *L. flava*, and *C. demersum* do not have high RFC and Use Value (UV) (Figure 4), presumably due to the erosion of ethnobotanical knowledge among local communities at the research site.

Indigenous knowledge in the study area and knowledge erosion

Each lake possesses its own unique local wisdom and traditional knowledge to maximize the potential of its surrounding natural resources. The analysis revealed that Lake Bontak has the highest EKI value, followed in sequence by Lake Tuo, Lake Talang, Lake Maninjau, Lake Singkarak, Lake Bawah, and Lake Atas (Figure 5).

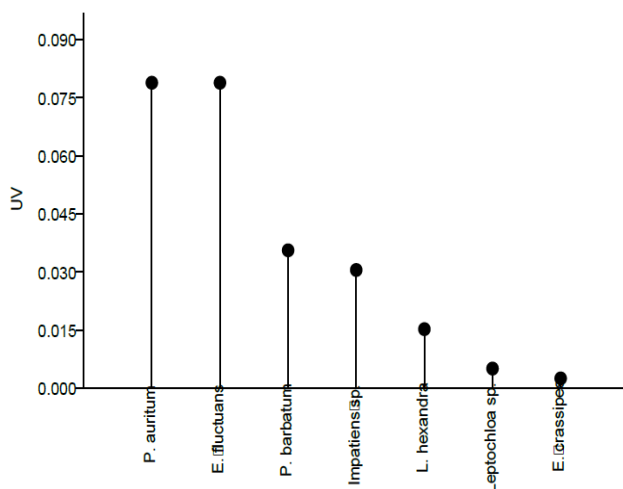


Figure 4. Use Value (UV) of traditional medicine aquatic flora

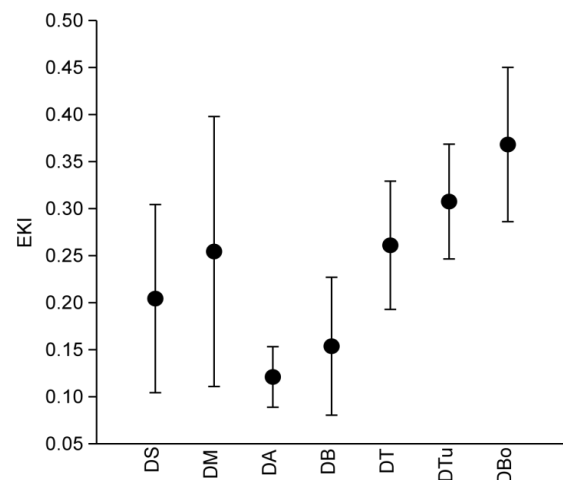


Figure 5. Value distribution of Ethnobotanical Knowledge Index in study area. Note: Lake(s): DA: Lake Diatas, DB: Lake Dibawah, DT: Lake Talang, DTu: Lake Tuo, DS: Lake Singkarak, DM: Lake Maninjau, DBo: Lake Bontak

Each lake has its own distinct local wisdom and traditional knowledge for maximizing the potential of its surrounding natural resources. The study found that populations near Lake Bontak have more ethnobotanical knowledge, with an Ethnobotanical Knowledge Index (EKI) of 0.368, than communities around other lakes. In contrast, Lake Diatas has the lowest EKI of 0.121 (Figure 5). This ailment is assumed to be linked to the higher level of modernization in the towns surrounding Lake Diatas, which use plants less traditionally. Furthermore, older age groups with ethnobotanical knowledge rarely pass on their information to the next generation, resulting in a decrease in traditional use.

These results support Navia et al.'s (2021) claim that modernity can eventually undermine existing local wisdom. As a result, some plant species that were once utilized as traditional medicines, including *Impatiens* sp., *P. barbatum*, *L. hexandra*, *Leptochloa* sp., and *E. crassipes*, are now less familiar to local communities. Furthermore, aquatic flora utilized as food is no longer a primary ingredient, most likely due to a drop in key informants, particularly among the elderly. According to Syamsuardi et al. (2022), age and gender discrepancies have a substantial impact on ethnobotanical knowledge, limiting its effective transfer. This shows that cultural, demographic, and modernization factors have a major impact on community knowledge about the exploitation of natural resources in lake environments

Comparison of respondents' Ethnobotanical Knowledge Index (EKI) based on several demographic variables, including lake location, gender, age group, and highest level of education (Table 7). This analysis aims to identify factors influencing variations in levels of ethnobotanical knowledge among respondents. Based on the lake location variable, there was a significant difference in EKI values between respondents ($W=115.0$; $p=0.0001$). Respondents from Lake Bontak showed the highest average EKI value (0.362 ± 0.331), followed by Lake Tuo (0.307 ± 0.232) and Lake Talang (0.261 ± 0.176). Conversely, the lowest EKI value was found in respondents from Lake Diatas (0.110 ± 0.103). This difference indicates that environmental factors and socio-cultural conditions around the lake play an important role in maintaining and transmitting ethnobotanical knowledge. Communities that still depend on local natural resources tend to have higher levels of ethnobotanical knowledge.

Regarding gender, the average EKI value for male respondents (0.238 ± 0.237) was slightly higher than for female respondents (0.219 ± 0.224). However, statistical test results showed that this difference was not significant ($\chi^2=19.93$; $p=0.462$). This indicates that both men and women have relatively equal roles in mastering and passing on ethnobotanical knowledge in the studied communities. In contrast, the age group variable showed a significant difference in the EKI value ($W=15.08$; $p=0.02$). There was a tendency for the EKI value to increase with increasing age of respondents. The 66-75 age group had the highest EKI value (0.367 ± 0.264), while the 5-15 age group showed the lowest value (0.144 ± 0.065). This pattern indicates that ethnobotanical knowledge is more widely held by the older

generation, potentially reflecting a decline in the transfer of traditional knowledge to the younger generation. Meanwhile, based on the highest level of education, no significant differences were found in EKI scores between education groups ($W=5.87$; $p=0.118$). Interestingly, respondents with primary education had a higher average EKI score (0.299 ± 0.292) than respondents with secondary and higher education. This suggests that ethnobotanical knowledge is acquired more through direct experience and interaction with the environment, rather than through formal education.

Overall, these findings imply that the interplay of cultural, demographic, and modernization factors has a major impact on the amount of ethnobotanical knowledge in communities surrounding the lake. Cultural variables determine how traditions and natural resource use practices are passed down, whereas demographics, specifically age distribution and gender roles, influence opportunities for intergenerational knowledge transfer. Modernization tends to change community preferences away from traditional traditions and toward more practical or technologically oriented ways, putting local knowledge at risk of being lost. The interaction of these three factors not only explains the variation in ethnobotanical knowledge across locations, but it also emphasizes the importance of preservation strategies such as documentation, intergenerational education, and the integration of local practices with modern activities in ensuring the relevance and sustainability of local knowledge.

Table 7. Comparison of variables of respondents on their ethnobotanical knowledge

Variable	n	The average of EKI	Statistical test	p-value
Lake			$W=115.0$	0.0001
Maninjau	19	0.254 ± 0.214		
Singkarak	26	0.204 ± 0.114		
Tuo	43	0.307 ± 0.232		
Talang	53	0.261 ± 0.176		
Diatas	105	0.110 ± 0.103		
Dibawah	53	0.154 ± 0.125		
Bontak	94	0.362 ± 0.331		
Gender			$\chi^2=19.93$	0.462
Male	191	0.238 ± 0.237		
Female	202	0.219 ± 0.224		
Age			$W=15.08$	0.02
5-15	28	0.144 ± 0.065		
16-25	20	0.177 ± 0.050		
26-35	78	0.217 ± 0.187		
36-45	94	0.221 ± 0.204		
46-55	86	0.255 ± 0.282		
56-65	68	0.268 ± 0.281		
66-75	19	0.367 ± 0.264		
Latest education			$W=5.87$	0.118
Elementary school	77	0.299 ± 0.292		
Junior high school	150	0.233 ± 0.227		
Senior high school	157	0.205 ± 0.198		
Higher education	9	0.235 ± 0.095		

Note: n: Total respondents, EKI: Ethnobotanical Knowledge Index

Implications for conservation

The ethnobotanical findings in this study have important implications for aquatic plant conservation, particularly in integrating biodiversity conservation with the preservation of traditional knowledge. Species with high Relative Frequency of Citation (RFC) and Use Value (UV) values, such as *E. crassipes*, *E. fluctuans*, and *P. auritum*, demonstrate widespread recognition and utilization by communities for traditional medicine, food, crafts, and ecological functions. Therefore, conservation strategies for these species need to consider local socio-cultural aspects to ensure sustainable utilization practices and prevent threats to the sustainability of natural populations. Conversely, species with low RFC and Ethnobotanical Knowledge Index (EKI) values, such as *C. demersum*, demonstrate limited knowledge and utilization at the community level. This situation indicates a high risk of these species being neglected in lake management, particularly due to modernization and limited intergenerational knowledge transfer (Navia et al. 2021; Syamsuardi et al. 2022). Species with low RFC and EKI should be prioritized in ethnobotanical documentation programs to record remaining knowledge before it is completely lost, while also identifying potential untapped ecological functions or uses.

The low EKI values in several lakes also emphasize the urgency of implementing community-based monitoring. Involving local communities in monitoring the presence and condition of aquatic plants can raise awareness of lesser-known species and strengthen their role as stewards of lake ecosystems. This approach is relevant to ensuring that species with low ethnobotanical value remain a focus for management and conservation. Beyond social aspects, the results of this study emphasize the importance of lake management strategies that consider ecological conditions, particularly the stability of water physicochemical parameters such as pH and temperature. Stable water conditions are crucial for maintaining aquatic plant diversity, particularly the hydrophytic herbaceous plants that dominate tropical lakes (Lahon and Sahariah 2022). Adaptive lake management, including eutrophication control and habitat protection, will support the sustainability of species with both high and low ethnobotanical value. Thus, ethnobotanical indices such as the RFC and EKI can be used as conservation prioritization tools, with high-value species directed toward sustainable management, while low-value species are prioritized for documentation, education, and monitoring. This conservation approach, which integrates ecological, social, and cultural dimensions, has the potential to improve the sustainability of aquatic resources, local food security, and preserve the ethnobotanical values of communities surrounding the lakes of West Sumatra.

In conclusion, this study documents the diversity of aquatic plants and the ethnobotanical knowledge of communities in the lakes of West Sumatra, Indonesia. A total of 16 aquatic plant species belonging to 12 families were recorded, with species richness varying among lakes. *P. barbatum* was present in all lakes, while *P. auritum* occurred in most locations, indicating broad ecological

tolerance. Quantitative ethnobotanical analysis showed that *E. crassipes* had the highest Relative Frequency of Citation (RFC=0.47), reflecting widespread recognition and utilization by local communities. The highest Use Values were observed for *E. fluctuans* and *P. auritum* (UV=0.078), highlighting their importance in traditional medicinal practices. Informant Consensus Factor analysis revealed the strongest agreement for agricultural and handicraft uses (ICF=1.00), indicating highly standardized and specialized utilization. Ethnobotanical Knowledge Index values differed significantly among lakes, with the highest mean EKI recorded at Lake Bontak (0.362) and the lowest at Lake Diatas (0.110), suggesting uneven retention of traditional knowledge across sites. Therefore, further research should focus on long-term monitoring that integrates social and ecological aspects, particularly to understand the impact of anthropogenic pressures on aquatic plant diversity and the sustainability of ethnobotanical knowledge.

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