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Terrestrial Plants Around Historical Kawasoti Lake, Nawalpur District, Nepal

Asmit Neupane[1], Sachin Timilsina[1], Pooja Dumre[1]
[1]Tribhuvan University, Institute of Forestry, Nepal
Corresponding Author: Asmit Neupane; Email: asmitneupane111@gmail.com

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ABSTRACT

Historical Kawasoti Lake is an excellent hub for floral and faunal diversity located in the Bhabhar region of the Southern Nawalpur district. This study was carried out to access the status and diversity of terrestrial floral species around the Lake area. A species-area curve method was employed to determine the sampling quadrants and the area was surveyed and sampled by foot trail for data collection. A total of 19 sample quadrants each of 10m*10m for tree species and a nested plot of 3*3m for shrubs and 1*1m for herbs were laid by foot trail within each quadrant. The collected data were analyzed and the Important Value Index (IVI) of only tree species was calculated in MS- Excel. A total of 66 terrestrial plant species of 38 different families were recorded, among which 25 were trees (38%), 27 herbs (41%), 12 shrubs (18%), and 2 climber species (3%). Among 38 families, the Asteraceae family was dominant, followed by Poaceae, Lamiaceae, Moraceae, Malvaceae, Amaranthaceae, Apocynaceae, Fabaceae, and so on. Among 25 tree species, Moraceae was the most dominant family followed by Meliaceae, Rubiaceae, Malvaceae, and so on. *Shorea robusta* of the Dipterocarpaceae family has the highest IVI (62.16) followed by *Dalbergia sissoo* of the Fabaceae family (24.37), *Ziziphus mauritiana* of Malvaceae family (22.87), *Melia azedarach* of Meliaceae family (21.06), and least of *Carica papaya* of Caricaceae family (3.71). The result shows the floristic diversity and species richness around the lake area. So, further conservation programs need to be carried out in the future to conserve the ecological and social diversity of this lake sustainably. Also, this study will provide baseline information for plant specialists, foresters, and biologists to enhance the conservation of this floral species in this lake and also in different lake zones of Nepal.

INTRODUCTION

Freshwater resources are an inseparable part of the environment. They play an important role to support an ecosystem of all forms of life and regulate ecological aspects like climate and rainfall patterns, soil protection, flood-resistant, etc. along with daily life activities of humans and animals too (Cheng et al., 2014; Pant et al., 2018; Qaisar et al., 2018). Freshwater resources also support carbon sequestration, nutrient cycle, groundwater recharge, biodiversity maintenance, source of drinking water, fishing, irrigation, hydropower, recreation, medicinal species, and NTFPs (Naimanand Turner, 2000; Atkinson et al., 2017). Lakes are standing water bodies occupying basins that are not connected with the sea (Maitland, 2013). The capability of lakes to define the landscape and its ecological functioning leads them to become a vital element of the natural environment (Pant et al., 2017). Lakeshores are the ecotones with larger digits of species overturning within a short distance, so lakes have often been termed the hotspot of biodiversity (England et al., 2008). Lake Ecosystem is an indispensable part of human existence cherishing huge species of flora and fauna as the structural and functional value of lakes have a prominent role in subsistence, cultural, commercial, recreation, storing water, moderating drought, and water purification (Schallenberg et al., 2013). Nepal, the second richest country in water resources, has different forms of water bodies which include rivers, lakes, ponds, wetlands, reservoirs, streams, swamps, and agricultural fields (Petr and Swar, 2002). Out of the total area of Nepal, around

5% of the total land (around 745000 ha.) is covered by water bodies among which nearly 3.2% of the water resource area is occupied by lakes along with ponds and reservoirs (Sharma, 2008; Bhuju et al., 2012). Nepal harbors more than 6000 rivers, 3252 glaciers, 2323 glacial lakes, and 5358 tectonic and oxbow lakes (NLCDC, 2019). National Lakes Conservation Development Committee has identified a total of 5,358 lakes in 75 out of 77 districts of Nepal spreading at different locations and elevations (Bhuju et al., 2009; NLCDC, 2020). About one-fourth of the total biodiversity of Nepal is reported to be associated with lakes and/or wetlands (Thapa et al., 2020). Terai region of Nepal supports many rivers, lakes, and wetlands which is home to a large number of terrestrial and aquatic species. Terai region including Siwalik (< 1000m) is rich in floral diversity as it inhibits 1885 species of angiosperms, 81 species of pteridophytes, and 61 species of bryophytes (BPP, 1995).

In Nepal, lakes, ponds, and catchment areas are really important as they support a wide spectrum of flora and fauna which are on the brink of extinction. Plant diversity assessment is the basic step required to be performed by conservationists, policymakers, and stakeholders before drafting, formulating, and implementing conservation plans and policies. Understanding and identifying the importance and distribution of flora and fauna found across water sources is very essential (Rodrigues et al., 2004). Diversity analysis gives knowledge about different species lying within an area and their relation with other species and ecosystems. It has been reported that there will be a significant change in the storage and bearing capacity of lakes if negative drivers keep on continuing (Watson et al., 2019). The lakes of Nepal are demeaned due to the repercussions of anthropogenic activities (Deforestation, urbanization, overexploitation of natural resources, domestic and industrial pollutants, use of different chemical toxicants and pesticides) and natural disasters (flood, landslide, siltation, drought, etc.) which drastically change in the condition of lakes, and make it vulnerable (Sharma et al., 2012; Gautam et al., 2019). Because of these natural and anthropogenic causes, the lake is subjected to various threats like eutrophication, encroachment, invasion, loss of biodiversity, and reduction in water quality which questions the existence of lakes in near future.

Amongst the unexplored lakes of Nepal, Historical Kawasoti Lake is one of them. There is an urgent need to survey and study the floral biodiversity of the water resources of Terai as anthropogenic and natural consequences are affecting water bodies and their biodiversity (Jha, 2008). Historical Kawasoti Lake, despite being an excellent hub for flora and fauna along with its ecological and social importance, still lacks appropriate study and initiatives for conservation. Though the lake is an integral part of ecology, economy, livelihood, and conservation, not any survey and research have been done in the Kawasoti area regarding the lakes, surrounding ecology, floral diversity, and cross-cutting aspects. Thus, we aim to collect data and study the assessment of terrestrial plant species and their floral diversity around Historical Kawasoti Lake. The main objective of this study is to prepare a checklist of terrestrial floral species, and species composition and to calculate the Importance Value Index (IVI) of tree species found around the lake. This paper explicitly deals with the status of floral diversity around the Lake area which will result in the first scientifically documented article on the lake. The findings of this study would provide comprehensive information on plant species found around the lake and IVI would give the fact about the diversity of tree species, and shape the path for promoting biodiversity, and ecosystem diversity along with its conservation on a sustainable basis in the coming days.

MATERIALS AND METHODS

Study area

The study was conducted in June and July in Historical Kawasoti Lake (27.63313, 84.13141), often known as Taruwa Tal. It is a eutrophic lake with an area of around 5 hectares situated in the Bhabhar region of SouthernNawalpur district at an elevation of204 meters from the Mean Sea Level (MSL). The Kawasoti area is considered a wetland because it supports a higher level of biodiversity (terrestrial, aquatic, and wetland flora and fauna) and also has four more lakes forming a lake cluster. The depth and water flow of the lake are up to 8m and 250 liters per second respectively during the rainy season.

This area is surrounded by dense forest on the Northern side, grassy land and marshes along with weeds on the Western side, and roads along the Southern and Eastern sides. Especially during the rainy season, the lake is mostly covered by weeds and invasive species which limit the growth and development of indigenous species. It is home to a large number of rare and endangered birds, fishes, reptiles, and amphibians. More than 150 species of fish have believed to be found in the lake as per local villagers and fishermen. Different species of venomous and non-venomous snakes along crabs are frequently found in this area. It has been serving as a resting place for a critically endangered animal, Rhino (*Rhinoceros unicornis*) along with other domesticated animals. The lake is a major source of livelihood for the local marginalized and indigenous communities like Tharu, Gurung, Tamang, and Magar. It is an important natural resource in this area as it provides fresh drinking water for the community people. Indigenous people of this area directly depend on the lake area for agriculture, irrigation, fishing, fuelwood, fodder, medicinal plants, and livestock farming. Around 172ha of agricultural land is irrigated by the lake water.

Data collection

The lake was surveyed and sampled by foot trail for data collection. A species-area curve method was used to determine the number of sampling quadrants (Palmer, 2007). A total of 19 sample quadrates each of 10 x 10m for trees were taken along the foot trail in the forest. Nested plots of 3x3 m for shrubs and 1x1 m for herbs were laid within each quadrant (Dongol, 2002). The quadrates were laid on the ground in such a way that the plant species recorded on each quadrate should indicate variation in vegetation, density, dominance, and abundance (Bhadra and Pattanayak, 2016). Keywords like the Importance Value Index (IVI) and Quadrate sampling were used to collect related research articles as secondary data. The Map of Historical Kawasoti Lake was obtained from Open Street Map (https://www.openstreetmap.org) which is placed in ArcGIS 10.3 to prepare the study area map. The aquatic floral species were not studied as the water body was inaccessible. The terrestrial plant species were observed and identified on-site with the help of experts, and the local peoples. Those species which were not identified in the field were collected, tagged, dried, and brought to the Botany lab at the Institute of Forestry, Pokhara for further identification.

Data analysis

The collected data were tabulated and quantitatively analyzed in MS Excel. The frequency, relative frequency, dominance, relative dominance, density, and relative density were calculated to find out the IVI of a plant species in this study area, and based on the given formula, the IVI of only tree species was calculated (Hariyadi and Madduppa, 2021).

$$\text{Frequency (\%)} = \frac{\text{Number of quadrates of species occurrence} * 100\%}{\text{Total number of quadrates studied}}$$

$$\text{Relative frequency} = \frac{\text{Frequency of a species} * 100}{\text{Sum of frequency of all species}}$$

$$\text{Density} = \frac{\text{Total number of individuals of a species present in all quadrates}}{\text{Total number of quadrates studied}}$$

$$\text{Relative density} = \frac{\text{Density of a species} * 100}{\text{Sum of the density of all species}}$$

Dominance = Sum of the basal area occupied by stems of all individuals of a species in all the studied quadrates

where, basal area of a stem is represented by πr^2 and, r = Radius of the stem

$$\text{Relative dominance} = \frac{\text{Dominance of a species} * 100}{\text{Sum of the dominance of all species}}$$

IVI = Relative Frequency + Relative Density + Relative Dominance

RESULTS AND DISCUSSION

Species composition

A total of 66 terrestrial plant species from38 different families were recorded in Historical Kawasoti Lake. It includes 25 tree species (38%), 27herb species (41%), 12 shrub species (18%), and 2 climber species (3%). Among 38 families, Asteraceaewas is dominant with 8 species of plants followed by Poaceae (7 species), Lamiaceae (4 species), Moraceae, Malvaceae, Amaranthaceae, Apocynaceae, and Fabaceae family (3 species). Two families, each containing 2 plant species, and 28 families with just a single plant species were recorded in the study. The Asteraceae family was dominant in the study performed by Meragiaw et al. (2021) in a Kibate Forest in Southwestern Ethiopia. A study by Bano et al. (2017) in the Beer Hills along the Indus River in Pakistan also reveals Asteraceae as a dominant family with 8 species. A total of 7 species belonging to the Asteraceae family were recorded in a study performed by Pandey and Ghimire (2020) which is close to our finding where we recorded 8 species belonging to the Asteraceae family.

The 25 tree species collected during the study were from 20 different families. Moraceae was the most dominant family among trees (3 tree species) followed by Meliaceae, Rubiaceae, and Malvaceae (2 tree species) and 16 families with just a single tree species. A total of 27 species of herbs from 15 families were found during the study among which Poaceae was the dominant family followed by Asteraceae. Similarly, altogether 12 species of shrubs lying within 10 different families were found where Asteraceae was the most dominant family. Along with these, 2 climber species were also recorded from 2 different families. Among the recorded species, 7 species of flowers, 2 species of mushroom, 1 fern species, and 3 invasive species are included.

Major Plant Species

The major tree species found around the Historical Kawasoti Lake were *Shorearobusta*, *Melia azedarach*, *Dalbergia sissoo*, and *Ziziphus mauritiana.* The most common shrub species include *Clerodendruminfortunatum*, and *Colocasia esculenta* while *Cynodondactylon*, *Axonopuscompressus,* and *Ageratum conyzoides* were major herb species recorded around the lake. One of the endangered medicinal plants of Nepal which are listed in IUCN threat status E and CITES Appendix-II (GoN, 2006), *Rauvolfia serpentina* was also recorded in our study. A report of medicinal plants in Nawalparasi district prepared by Bhattarai et al. (2009) also discloses the presence of *Rauvolfiaserpentine* along with *Azadirachta indica*, *Cynodondactylon*, *Ocimumtenuiflorum,* and other medicinal plants which are recorded in our finding.

Among the recorded species, *Mikania micrantha*, *Lantana camara,* and *Partheniumsps*. were the major terrestrial invasive species while *Ipomea sps*., *Eichhornia sps*., and *Pistiasps* were aquatic invasive species. The above-mentioned terrestrial and aquatic invasive species were also recorded in the study performed by Shrestha (2019) compiling 26 naturalized plant species. Also, in a study conducted by Murphy et al. (2013) in Chitwan National Park (CNP), the massive spreading of *Mikania micrantha* was reported to lead to the degradation of indigenous and native flora which is analogous to our finding where a massive number of invasive species hinders the native environment. A study performed by Lowe et al. (2000) also revealed that the invasive macrophytes invaded many wetlands in the KoshiTappu which is similar to our finding that many invasive species invaded the area of Historical Kawasoti Lake. *Agaricusbisporus*and *Boletus edulis* was the fungus species present around the lake. *Ipomea carnea* of *Ipomea sps* was also recorded in the study carried out by Bhandari et al. (2021) in Ghodaghodi Lake Complex which is found as aquatic invasive species in our study area too.

According to Shaligram Sapkota, Chairman of Historical Kawasoti Lake Management Committee,

in collaboration with Lake User's Group, a management committee was formed in 2004 A.D. It has been doing a remarkable job for the management of invasive species by clearing them once a year, with the participation of local people in a sustainable way. A major milestone for its conservation date back to 2016 A.D with the institutionalization of an organization named "Historical Kawasoti Lake Conservation and Water Irrigation User Group". This helps to enhance the biodiversity level in and around this historical lake.

Importance Value Index (IVI)

Trees consist highest percentage composition (38%) followed by herbs (32%), flowers (10.6%), shrubs and terrestrial invasive species (7.50%), mushrooms (3%), and least by ferns (1.50%). There was similar percentage composition of both shrubs and terrestrial invasive species (Table 1).

Table 1. Presence of terrestrial plant species

Plant Species	**Percentage composition**
Trees	38%
Herbs	32%
Shrubs	7.50%
Flowers	10.60%
Mushroom	3%
Fern	1.50%
Terrestrial Invasive Species	7.50%

Source: Authors' finding

Among the tree species found around the lake, *Shorearobusta* of the Dipterocarpaceae family has the highest IVI (62.16) which is similar to the finding of Pandey and Ghimire (2020) who observed *S. robusta* as a frequently observed tree species followed by *Dalbergia sissoo* of Fabaceae family (24.37). *Ziziphus mauritiana* of the family Malvaceae has the 3rd highest IVI (22.87) followed by *Melia azedarach* of the family Meliaceae (21.06) while *Carica papaya* of the family Caricaceae has the lowest IVI (3.71) among tree species. A study carried out by Pathak and Baniya (2017) also shows the dominance of *S. robusta* forest in a community-managed tropical *S. robusta* forest in Nawalparasi, Nepal. Among the 20 families of tree species, Dipterocarpaceae has the highest IVI (62.16) followed by Meliaceae (37.31), and Malvaceae (29.44) respectively. The IVI of tree species found in Historical Kawasoti Lake is shown in Table 2.

S.N.	Scientific Name	Local Name	Family	F	RF	D	RD	Do.	RDo.	IVI
1	*Aegle marmelos* (L.) Corr.	Bel	Asteraceae	15.79	2.59	0.0021	1.74	13175	2.10	6.42
2	*Alnus Nepalensis* D. Don	Uttis	Betulaceae	31.58	5.17	0.0047	3.91	13035	2.07	11.16
3	*Anthocephaluscadamba* Miq	Kadam	Rubiaceae	21.05	3.45	0.0026	2.17	14760.3	2.35	7.97
4	*Artocarpus heterophyllus* Lam.	Katahar	Moraceae	10.53	1.72	0.0011	0.87	8365.9	1.33	3.92
5	*Azadirachta indica* A.Juss	Neem	Meliaceae	36.84	6.03	0.0063	5.22	31418	4.99	16.25
6	*Bombax ceiba* L.	Simal	Rudaceae	21.05	3.45	0.0026	2.17	20051.3	3.19	8.81
7	*Carica papaya* L.	Mewa	Caricaceae	10.53	1.72	0.0016	1.30	4292	0.68	3.71
8	*Coffea arabica* L.	Coffee	Rubiaceae	10.53	1.72	0.0026	2.17	1204.9	0.19	4.09
9	*Dalbergia sissoo* Roxb. ex DC	Sisau	Fabaceae	57.89	9.48	0.0095	7.83	44404.5	7.06	24.37
10	*Dendrocalamushamiltonii* Gambie	Choya Baas	Poaceae	26.32	4.31	0.011	8.69	7944.3	1.26	14.27
11	*Ficus auriculata* Lour.	Nimaro	Moraceae	21.05	3.45	0.0026	2.17	11686.7	1.86	7.48
12	*Ficus religiosa* L.	Peepal	Moraceae	10.53	1.72	0.0011	0.87	16119.7	2.56	5.16
13	*Garuga pinnata* Roxb	Dabdabe	Burseraceae	26.32	4.31	0.0042	3.45	48422.9	7.70	15.49
14	*Gossypium arboretum* L.	Kapas	Malvaceae	15.79	2.59	0.0047	3.91	455.1	0.08	6.57
15	*Litseamonopetala* (Roxb.) Pers	Kutmiro	Lauraceae	21.05	3.45	0.0026	2.17	10028.7	1.59	7.22
16	*Magnifera indica* L.	Aanp	Anacardiaceae	21.05	3.45	0.0021	1.74	881.7	0.14	5.33
17	*Melia azedarach* L.	Bakaino	Meliaceae	42.11	6.89	0.013	10.43	23450.4	3.73	21.06
18	*Micheliachampaca* L.	Champ	Magnoliaceae	15.79	2.59	0.0021	1.74	6495.8	1.03	5.36
19	*Musa paradisiaca* L.	Kera	Musaceae	15.79	2.59	0.0053	4.35	31068.9	4.94	11.88
20	*Paulownia tomentosa* (Thunb.) Steud	Paulownia	Paulowniaceae	36.84	6.04	0.0095	7.83	18357.9	2.92	16.78
21	*Phyllanthus emblica* L.	Amala	Phyllanthaceae	10.53	1.72	0.0011	0.87	4457.4	0.71	3.30
22	*Shorearobusta*Gaertn.	Sal	Dipterocarpaceae	63.16	10.34	0.018	14.78	232732.8	37.03	62.16
23	*Terminalia bellerica* (Gaertn.) Roxb.	Barro	Combretaceae	10.53	1.72	0.0011	0.87	7643.4	1.22	3.81
24	*Trewianudiflora* L.	Vellar	Malvaceae	42.11	6.89	0.0084	6.96	56664.7	9.02	22.87
25	*Ziziphus mauritiana*Lam.	Bayer	Rhamnaceae	15.79	2.59	0.0021	1.74	1413.4	0.22	4.55

Source: Authors finding

Asteraceae and Poaceae family have highest number of tree species (4) followed by moraceae (3), fabaceae (3), malvaceae (3), rubiaceae (2), meliaceae (2), and rest of other families have individual number of tree species (Table 3).

Table 3. Family-wise diversity in tree species

Family	**Number of tree species**
Asteraceae	4
Betulaceae	1
Rubiaceae	2
Moraceae	3
Meliaceae	2
Rudaceae	1
Caricaceae	1
Fabaceae	3
Poaceae	4
Burseraceae	1
Malvaceae	3
Lauraceae	1
Anacardiaceae	1
Magnoliaceae	1
Musaceae	1
Paulowinaceae	1
Phyllanthaceae	1
Dipterocarpaceae	1
Combretaceae	1
Rhamnaceae	1

Source: Authors' finding

Asteraceae family has the highest number of plant species (8) followed by poaceae (7), lamiaceae (4), moraceae (3), fabaceae (3), malvaceae (3), amaranthaceae (3), apocynaceae (3), rubiaceae (2), meliaceae (2), and rest of all families have an individual number of plant species (Table 4).

Table 4. Family-wise diversity in total plant species

Family	**Number of plant species**
Asteraceae	8
Betulaceae	1
Rubiaceae	2
Moraceae	3
Meliaceae	2
Rudaceae	1
Caricaceae	1
Fabaceae	3
Poaceae	7
Burseraceae	1
Malvaceae	3
Lauraceae	1
Anacardiaceae	1
Magnoliaceae	1
Musaceae	1
Paulowinaceae	1
Phyllanthaceae	1
Dipterocarpaceae	1
Combretaceae	1
Rhamnaceae	1
Amaranthaceae	3
Acoraceae	1
Apocynaceae	3
Cyperaceae	1
Convolvulaceae	1
Juncaceae	1
Lamiaceae	4
Urticaceae	1
Araceae	1
Zingiberaceae	1
Rosaceae	1
Pteridaceae	1
Discoreaceae	1
Compositae	1
Dyropteridaceae	1
Verbenaceae	1
Agaricaceae	1
Boletaceae	1

Source: Authors finding

A total of 27 herbs species were found in the Historical Kawasoti Lake followed by shrubs (12) and climbers (2) as major plant species. 4 flower species and 2 mushroom species were listed under the herbs category. Also, 2 flower species, 1 fern species, and 3 invasive species were recorded under the shrubs category. The checklist of other terrestrial plant species (herbs, shrubs, flowers, fungus, fern, climber, and invasive species) is shown in Table 5.

Table 5. Plant species found at Historical Kawasoti Lake

Herbs:				
S.N.	Scientific Name	Local Name	Family	Category
1	*Achyranthes aspera* L.	Ultekurro	Amaranthaceae	Herb
2	*Acorus Calamus* L.	Bojho	Acoraceae	Herb
3	*Ageratum conyzoides* L.	Ganaune	Asteraceae	Herb
4	*Amaranthus spinosus* L.	Seto Lode	Amaranthaceae	Herb
5	*Axonopuscompressus* (SW) P. Beauv	Hade dubo	Poaceae	Herb
6	*Bidens pilosa* L.	Kalokuro	Asteraceae	Herb
7	*Centella asiatica* (L.) Urb	Ghodtapre	Apocynaceae	Herb
8	*Cynodondactylon* (L.) Pers.	Dubo	Poaceae	Herb
9	*Cyperus rotundus* L.	Mothe	Cyperaceae	Herb
10	*Digittariasetigera* Roth ex R. and S	Banso	Poaceae	Herb
11	*Eleusine indica* (L.) Gaertn.	Kodejhar	Poaceae	Herb
12	*Ipomoea carnea* Jacq.	Besaram	Convolvulaceae	Herb
13	*Juncus inflexus* L.	Ghodeghaas	Juncaceae	Herb
14	*Mimosa pudica* L.	Lajawati	Fabaceae	Herb
15	*Ocimumtenuiflorum* L.	Tulsi	Lamiaceae	Herb
16	*Oplismenusburmannii* (Retz.) P. Beauv.	Gobreghaas	Poaceae	Herb
17	*Pilea pumila* (L.) A.Gray	Clearweed	Urticaceae	Herb
18	*Rauvolfia serpentina* (L.) Benth.	Sarpaghanda	Apocynaceae	Herb
19	*Senna tora* (L.) Roxb.	Chakmakey	Fabaceae	Herb
20	*Sidarhombifolia* L.	Khareto	Malvaceae	Herb
21	*Spilanthespaniculata* Wall. Ex DC.	Marathi	Asteraceae	Herb
22	*Catharanthus roseus* (L.) G.Don	Sadabaharphool	Apocynaceae	Flower
23	*Plectranthusamboinicus* Lour.	Pattaajjwain	Lamiaceae	Flower
24	*Zinnia elegans* Jacq.	Zinnia	Asteraceae	Flower
25	*Coleus forskholii*	Makandi	Lamiaceae	Flower
26	*Agaricusbisporus* (J.E.Lange)	Gobrechhyau	Agaricaceae	Mushroom
27	*Boletus edulis* Bull.	Dallechhyau	Boletaceae	Mushroom
Shrubs:				
1	*Artemisia vulgaris* L.	Titepati	Asteraceae	Shrub
2	*Clerodendruminfortunatum* L.	Bhat	Lamiaceae	Shrub
3	*Colocasia esculenta* (L.) Schott	Gava	Araceae	Shrub
4	*Curcuma Longa* L.	Besar	Zingiberaceae	Shrub
5	*Saccharum officinarium* L.	Ukhu	Poaceae	Shrub
6	*Gomphrena globose* L.	Makhamali	Amaranthaceae	Shrub
7	*Rosa alba* L.	Gulaab	Rosaceae	Flower
8	*Tagetes erecta* L.	Sayapatri	Asteraceae	Flower
9	*Dryopteris cochleata* (D. Don) P. Beauv	Jatashankari	Dyropteridaceae	Fern
10	*Mikania micrantha* Kunth.	Banmara	Compositae	Invasive
11	*Lantana camara* (L.) Mol.	Sitayiphul	Verbenaceae	Invasive
12	*Parthenium hysterophorus* L.	Bahudalghaas	Asteraceae	Invasive

Climbers:				
1	*Adiantum capillus-veneris* L.	Unyu	Pteridaceae	Climber
2	*Dioscoreadeltoidea* Wall ex Kunth.	Vyakur	Discoreaceae	Climber

Source: Author findings

CONCLUSION

The study provides the checklist and diversity of all herbs, shrubs, trees, and fungal species recorded around Historical Taruwa Lake. A total of 66 terrestrial plant species representing 38 families, among which 25 (38%) were trees, 27 (41%) herbs, 12 (18%) shrubs, and 2 (3%) climber species are documented around the lake where the Asteraceae is a dominant family with 8 floral species. The IVI calculation among tree species shows that *Shorearobusta* of the Dipterocarpaceae family has the highest IVI (62.16) followed by *Dalbergia sissoo* of the Fabaceae family (24.37). This study is conducted in just one season (summer season) so the number of plant species may be more or less in different seasons, especially herbs and shrubs. This study found that Historical Kawasoti Lake is rich in floristic diversity and home to various plant species. The findings of this study on different species of herbs, shrubs, and trees can surely be implemented in the biodiversity assessment, management, and conservational master plan. Identification of Historical Kawasoti Lake as an important hub for biodiversity along with conservation and promotion initiatives for maintaining biodiversity is required. More studies and research are required to document the detailed floral composition and patterns of diversity as well as to document the indigenous and endemic medicinal flora found around the lake and Kawasoti area.

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