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FLORISTIC COMPOSITION, UTILIZATION AND LOCAL PERCEPTION OF MADHUPUR SAL FOREST, TANGAIL, BANGLADESH

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Abstract

The Sal (*Shorea robusta*) forests of Bangladesh, particularly the Madhupur tract, are ecologically significant yet increasingly threatened by anthropogenic pressures and habitat fragmentation. This study was conducted in the Dokhola village adjacent to the Madhupur Sal Forest to evaluate the phytosociological structure and plant species diversity across four growth forms. Vegetation was sampled using a nested quadrat approach. Importance Value Index (IVI) was calculated for each species. A total of 83 plant species were recorded, comprising 44 trees, 16 shrubs, 11 herbs, and 12 climbers/lianas. *Shorea robusta* overwhelmingly dominated the tree stratum (IVI = 128.26), while *Clerodendrum infortunatum* dominated the shrub layer (IVI = 64.28). The herbaceous layer exhibited extreme suppression, with *Ageratum conyzoides* commanding 74% of the stratum (IVI = 222.35). Among climbers, *Paederia foetida* (IVI = 81.53) and *Mikania micrantha* (IVI = 54.21) were co-dominant. Questionnaire surveys revealed that 66% of local respondents depend on forest resources, contributing to diversity decline. Respondents recommended awareness campaigns, sustainable non-timber forest product harvesting, and exotic species control. This study provides baseline data urgently needed for conservation planning and sustainable management of Sal forests.

Introduction

Forests are among the most biodiverse and ecologically significant ecosystems on Earth, serving as carbon sinks, biodiversity hotspots, and regulators of climate and hydrological cycles (Upadhyay and Singh 2024). In tropical and subtropical regions, forests also provide essential ecosystem services, including soil fertility, water retention, and habitat for diverse species. (Borma *et al.* 2022). Forest ecosystems of Bangladesh, despite their small area, play a disproportionately significant role in regional biodiversity and ecological balance (Barua *et al.* 2020). These forests are categorized into three primary types such as tropical evergreen and semi-evergreen forests, coastal mangrove forests, and deciduous Sal forests. Among these, the deciduous Sal forests are predominantly found in central Bangladesh, encompassing approximately 32% total forestland of the country (Rahman and Vacik 2010).

The Madhupur Sal Forest, one of the most prominent deciduous forest ecosystems in Bangladesh, is dominated by Sal (*Shorea robusta*) and features a complex assemblage of associated flora and fauna (Jaman *et al.*2024). This forest not only supports the livelihoods of local communities through its provisioning services but also acts as a reservoir for plant genetic resources, some of which are endemic or threatened (Alam 2016). Despite its importance, the Madhupur Sal Forest faces escalating threats from deforestation, land-use changes, overexploitation of resources, and invasive species. These pressures have resulted in habitat fragmentation, reduced forest cover, and a decline in species diversity, posing a significant

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challenge to its ecological integrity and sustainability (Ahmed *et al.* 2024). According to Uddin and Misbahuzzaman (2007), many plant and animal species that were once extensively spread are now either extinct or only exist in a few restricted locations at extremely low population densities. To effectively conserve and manage such ecosystems, a robust understanding of species composition, abundance, and ecological roles is essential (Kanagaraj *et al.* 2016). The Importance Value Index (IVI) offers a standardized approach to evaluating plant species' ecological significance by integrating metrics such as relative density, relative frequency, and relative dominance. IVI not only provides insights into the community structure but also helps identify keystone species and prioritize conservation actions (Ahmed *et al.* 2018). Although the diversity and composition of tree species in Madhupur Sal forest (Rahman *et al.* 2019), as well as the soil physicochemical properties of the forest (Propa *et al.* 2021), have been studied, a comprehensive analysis of the species composition of the entire plant community in recent years has not been conducted.

In light of the aforementioned information, the current study was conducted to evaluate the structural makeup and diversity of plant species in the Dokhola village adjacent to the Madhupur Sal forests, which are essential components of the plain land Sal forests of Bangladesh. Furthermore, the respondents' perceptions of the management plan about the conservation strategy for the forest flora of the Sal regions under survey were also reflected in this present inventory. It was anticipated that these baseline data would show the current state of these vulnerable habitats, which can be used to conserve biodiversity and establish appropriate management plans.

Materials and Methods

The study was conducted from 27 December 2023 to 07 June 2024. The study area comprises a part of Sal Forest, which is situated at the Dokhola village in the Madhupur Upazila of Tangail district (Fig. 1). The forest extends between 23°50´- 24°50´ N and 89°54´- 90°50´ E (Nishat *et al.* 2002), covering an area of 24150.02 ha which are honeycombed with habitation and agricultural land comprising four ranges namely Madhupur, Soronokhola, Dokhola arid and Madhupur National Park Sadar.

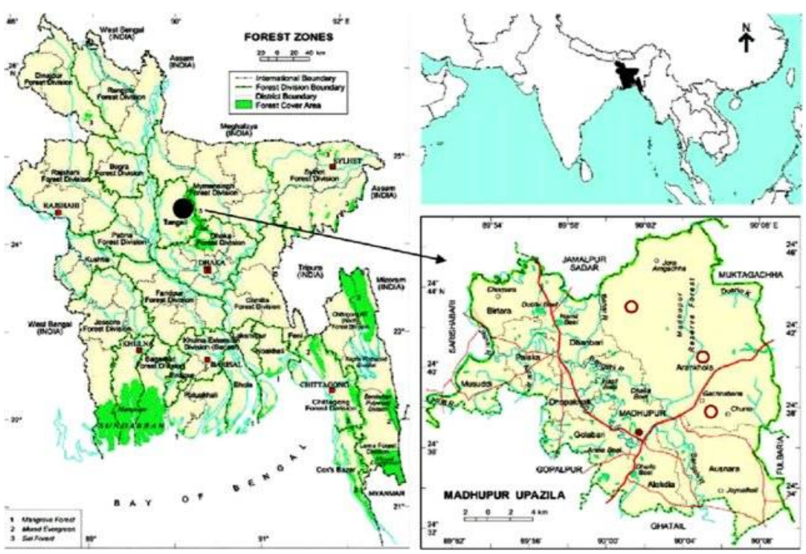

Fig. 1. Map showing the forest cover of Madhupur, Tangail.

Vegetation sampling was conducted using a nested quadrat approach wherein fifteen 10 m × 10 m quadrats were randomly established for the tree stratum, within each of which five 5 m × 5 m quadrats were randomly placed for the shrub stratum and five 1 m × 1 m sub-quadrats for the herb stratum, while climbers and lianas were recorded simultaneously within the tree quadrats as well as within the shrub and herb quadrats when encountered. Importance Value Index is used to determine the overall importance of each species in the community structure. In calculating this index, the percentage values of the relative frequency, relative density, and relative abundance are summed up together and this value is designated as the Importance Value Index (IVI) of the species. IVI was calculated using the method applied by Bhadra and Pattanayak (2017).

The data was collected from both primary and secondary sources. A pre-tested structural questionnaire was used to collect primary data. Key informant interviews were performed with indigenous people who depended on forest resources for a variety of reasons. Local perspectives were gathered by randomly selecting respondents from research regions. To learn more about the general opinions of the public on Sal Forest, a Focus Group Discussion (FGD) was conducted at the Dokhola Bazar. Using FGD, it is also technically gathered responses to study questions.

All of the unique and spatial data that was gathered from various sources has been compiled and examined independently. Microsoft Excel was used to create graphical presentations and evaluate the spatial data.

Results and Discussion

Quantitative sampling of the plant community within the studied Madhupur forest ecosystem revealed a highly structured vegetative layout distributed across four distinct biological growth forms: trees, shrubs, herbs, and climbers/lianas.

The overstory and intermediate canopy layer represented the highest floristic diversity within the plot, containing 44 species. The phytosociological landscape was overwhelmingly characterized by the absolute dominance of *Shorea robusta*, which recorded a Relative Density (RD) of 70.60%, Relative Frequency (RF) of 20.32%, and Relative Abundance (RA) of 37.34%, yielding a premier IVI of 128.26. This emphasizes *S. robusta* as the ultimate climax dominant indicator of this tract (Table 1).

The secondary overstory tier was weakly supported by a small canopy associate complex, primarily led by *Aphanamixis polystachya* (IVI = 21.94) and the large deciduous canopy tree *Terminalia bellirica* (IVI = 12.01) (Table 1). Additional prominent associates filling the spatial matrix included *Dillenia pentagyna* (IVI = 11.84) and the exotic timber species *Acacia auriculiformis* (IVI = 11.22). The remaining 39 tree species, including indicators such as *T. arjuna* (IVI = 8.03), *L. speciosa* (IVI = 6.98), and *S. suaveolens* (IVI = 5.74), maintained minor structural holds (IVI < 6.00), revealing a high sub-canopy richness dominated by scattered individuals or rare transient cohorts.

The understory layer was composed of 16 woody perennial and soft-wooded bush species (Table 2). Structurally, the floor-adjacent zone was heavily dominated by *Clerodendrum infortunatum*, which achieved a substantial IVI of 64.28, driven largely by its high-density profile (RD% = 29.83%). The secondary tier of the shrub stratum was strongly co-occupied by a rigid, spiny associate matrix. *Randia dumetorum* emerged with the highest spatial distribution frequency across sampling blocks (RF% = 13.54%, IVI = 40.98). *Mallotus philippensis* (Lam.) Müll.Arg. (Sinduri) manifested balanced competitive values yielding an IVI of 37.46, while *Glycosmis pentaphylla* displayed strong sub-canopy grouping patterns, reaching an IVI of 36.08.

Table 1. Relative frequency (RF), relative density (RD), relative abundance (RA) and importance value index (IVI) of tree species in surveyed areas.

SI. No.	Local name	Scientific name	RF%	RD%	RA%	IVI
1	Ajuli	*Dillenia pentagyna* Roxb.	4.9	2.7	4.24	11.84
2	Akashmoni	*Acacia auriculiformis* A.Cunn. ex Benth.	6.3	1.69	3.23	11.22
3	Am/Mango	*Mangifera indica* L.	1.63	0.25	1.15	3.03
4	Amloki	*Phyllanthus emblica* L.	1.63	0.25	1.15	3.03
5	Arjun	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	2.63	0.25	5.15	8.03
6	Aswath	*Ficus religiosa* L.	1.38	1.1	1.13	3.61
7	Bel	*Aegle marmelos* (L.) Corrêa	1.63	0.25	1.15	3.03
8	Bohera	*Terminalia bellirica* (Gaertn.) Roxb.	4.61	3.25	4.15	12.01
9	Bot	*Ficus benghalensis* L.	0.38	0.27	0.37	1.02
10	Chatim	*Alstonia scholaris* (L.) R.Br.	1.63	0.25	1.15	3.03
11	Chesra koroi	*Albizia chinensis* (Osbeck) Merr.	0.36	0.25	0.35	0.96
12	Debdaru	*Polyalthia longifolia* (Sonn.) Thwaites	1.63	0.25	1.15	3.03
13	Dudh-kuruch	*Wrightia arborea* (Dennst.) Mabb.	1.63	1.49	2.32	5.44
14	Dumur	*Ficus carica* L.	1.63	0.25	1.15	3.03
15	Gadila	*Careya arborea* Roxb.	1.63	0.25	1.15	3.03
16	Halud krisnachura	*Peltophorum pterocarpum* (DC.) K.Heyne	0.35	0.25	0.34	0.94
17	Horitoki	*Terminalia chebula* Retz.	1.63	1.25	1.15	4.03
18	Jam	*Syzygium cumini* (L.) Skeels	1.63	0.25	1.15	3.03
19	Jarul	*Lagerstroemia speciosa* (L.) Pers.	2.63	2.25	2.1	6.98
20	Jiga/Jeol	*Lannea coromandelica* (Houtt.) Merr.	1.63	0.25	1.15	3.03
21	Jongliboroi	*Ziziphus rugosa* Lam.	1.63	0.25	1.15	3.03
22	Kadam	*Anthocephalus cadamba* (Roxb.) Miq.	1.63	0.25	1.15	3.03
23	Kala Koroi	*Albizia lebbeck* (L.) Benth.	0.47	0.29	0.49	1.25
24	Kan sonalu	*Stereospermum suaveolens* (Roxb.) DC.	3.27	0.74	1.73	5.74
25	Kanchan	*Bauhinia variegata* L.	1.63	0.25	1.15	3.03
26	Kanjal Bhadi	*Bischofia javanica* Blume	0.33	0.23	0.32	0.88
27	Khejur	*Phoenix sylvestris* (L.) Roxb.	0.35	0.25	0.34	0.94
28	Krisnachura	*Delonix regia* (Bojer ex Hook.) Raf.	0.35	0.25	0.34	0.94
29	Kurch/Kuruj	*Holarrhena pubescens* Wall. ex G.Don	1.63	0.49	2.32	4.44
30	Lohakat	*Xylia kerrii* Craib & Hutch.	1.63	0.25	1.15	3.03
31	Mahagoni	*Swietenia mahagoni* (L.) Jacq.	0.35	0.25	0.34	0.94
32	Mandar	*Erythrina variegata* L.	1.63	0.25	1.65	3.53
33	Neem	*Azadirachta indica* A.Juss.	1.63	0.25	1.65	3.53
34	Palash	*Butea monosperma* (Lam.) Taub.	0.36	0.25	0.35	0.96
35	Pitraj	*Aphanamixis polystachya* (Wall.) R.Parker	12.61	4.79	4.54	21.94
36	Raintree	*Samanea saman* (Jacq.) Merr.	0.38	0.27	0.37	1.02

37	Raj koroi	*Albizia richardiana* (Voigt) King & Prain	1.1	0.25	0.34	1.69
38	Ranggula	*Bixa orellana* L.	1.31	0.91	1.93	4.15
39	Sal	*Shorea robusta* C.F.Gaertn.	20.32	70.6	37.34	128.26
40	Shil koroi	*Albizia procera* (Roxb.) Benth.	1.63	0.25	1.15	3.03
41	Shimul	*Bombax ceiba* L.	0.36	0.25	1.85	2.46
42	Sonalu	*Cassia fistula* L.	1.38	0.97	1.37	3.72
43	Tetul	*Tamarindus indica* L.	1.63	0.25	1.15	3.03
44	Tujha	*Thuja orientalis* L.	0.92	0.21	0.95	2.08

Table 2. Relative frequency (RF), relative density (RD), relative abundance (RA) and importance value index (IVI) of shrub species in surveyed areas.

SI. No.	Local name	Scientific name	RF%	RD%	RA%	IVI
1	Akando	*Calotropis gigantea* (L.) R.Br.	5.66	2.35	4.04	12.05
2	Bajna	*Zanthoxylum rhetsa* (Roxb.) DC.	0.4	0.32	0.51	1.23
3	Basok	*Justicia adhatoda* L.	0.4	0.32	0.86	1.58
4	Bet	*Schumannianthus dichotomus* (Roxb.) Gagnep.	7.55	6.38	8.25	22.18
5	Bhat	*Clerodendrum infortunatum* L.	15.11	29.83	19.34	64.28
6	Bon Begun	*Solanum torvum* Sw.	7.55	4.37	5.65	17.57
7	Chitki	*Phyllanthus reticulatus* Poir.	11.33	3.68	3.17	18.18
8	Datai	*Microcos paniculata* L.	3.78	1.01	2.9	7.69
9	Jagatmadan	*Justicia gendarussa* Burm.f.	4.38	2.32	4.48	11.18
10	Jamal gota	*Croton tiglium* L.	4.36	4.29	4.46	13.11
11	Monkata	*Randia dumetorum* (Retz.) Poir.	13.54	15.77	11.67	40.98
12	Motkila	*Glycosmis pentaphylla* (Retz.) DC.	9.44	13.07	13.57	36.08
13	Muchonda	*Mussaenda roxburghii* Hook.f.	1.4	0.34	2.51	4.25
14	Sheora	*Streblus asper* Lour.	3.78	1.01	2.6	7.39
15	Sinduri	*Mallotus philippensis* (Lam.) Müll.Arg.	9.44	13.76	14.26	37.46
16	Ulatkombol	*Abroma augusta* L.	1.88	1.18	1.73	4.79

Lesser understory elements such as *Schumannianthus dichotomus* (IVI = 22.18), *Phyllanthus reticulatus* (IVI = 18.18), and *Solanum torvum* (IVI = 17.57) formed stable intermediate clusters, whereas early successional indicators like *Zanthoxylum rhetsa* (IVI = 1.23) and *Justicia adhatoda* (IVI = 1.58) remained structurally suppressed.

The herbaceous ground layer exhibited an extreme ecological bottleneck across its 11 recorded species (Table 3). The single consolidated morphotype complex *Ageratum conyzoides* L. asserted complete absolute dominance over the forest floor cover. *A. conyzoides* sequestered an extraordinary IVI of 222.35, commanding approximately 74% of the entire stratum's frequency, density, and abundance parameters combined (RF% = 74.81%, RD% = 74.96%, RA% = 72.58%).

This massive competitive suppression restricted all other ground flora to localized micro-refugia. Only *Blumea lacera* (IVI = 18.16), *Centella asiatica* (IVI = 11.10), and *Vernonia cinerea* (VI = 10.77) managed to cross into double-digit index weights. Traditional forest floor geophytes and broadleaf herbs, such as *Amorphophallus bulbifer* (IVI = 7.41) and *Canna indica* (IVI = 5.86), represented marginal remnants of the ground layer.

Table 3. Relative frequency (RF), relative density (RD), relative abundance (RA) and importance value index (IVI) abundance of herb species in surveyed areas.

SI. No.	Local name	Scientific name	RF%	RD%	RA%	IVI
1	Barokukshim	*Blumea lacera* (Burm.f.) DC.	5.45	6.58	6.13	18.16
2	Chakunda	*Senna tora* (L.) Roxb.	2.23	0.54	1.04	3.81
3	Dholpata	*Commelina benghalensis* L.	2.23	1.5	1.04	4.77
4	Fulkhori / Ochunti	*Ageratum conyzoides* L.	74.81	74.96	72.58	222.35
5	Jongle Ol	*Amorphophallus bulbifer* (Roxb.) Blume	2.01	2.46	2.94	7.41
6	Jongli Ada	*Zingiber roseum* (Roxb.) Roscoe	2.12	1.5	2.99	6.61
7	Kalokeshi	*Eclipta alba* (L.) Hassk.	2.23	0.5	1.04	3.77
8	Kolaful	*Canna indica* L.	2.46	1.46	1.94	5.86
9	Lajibati	*Mimosa pudica* L.	2	1.5	1.89	5.39
10	Shial lata	*Vernonia cinerea* (L.) Less.	2.23	4.5	4.04	10.77
11	Thankuni	*Centella asiatica* (L.) Urb.	2.23	4.5	4.37	11.1

The climbing flora consisted of 12 canopy-scaling or prostrate woody and herbaceous twiners (Table 4). The structural framework of this matrix was co-dominated by two principal invasive and native taxa. *Paederia foetida* held the premier position within the vine community, reaching an IVI of 81.53 based on a high Relative Abundance (29.47%). *Mikania micrantha* served as a primary co-dominant canopy-blanketing twiner, securing an IVI of 54.21 (RF% = 26.73%). Its sister native species, *Mikania cordata* also represented a substantial portion of the climbing layer with an IVI of 47.16. Together, these three twiners comprised more than half of the climbing stratum's total index values. The remaining structural space was divided evenly among minor wild food tubers, rattan canes, and spiny lianas, including *Dioscorea esculenta* (IVI = 15.02), *Calamus tenuis* (IVI = 14.65), and *Ziziphus oenoplia* (IVI = 12.81), all demonstrating stable, low-density patterns across the host tree architectures.

Table 4. Relative frequency (RF), relative density (RD), relative abundance (RA) and importance value index (IVI) of climber species in surveyed areas.

SI. No.	Local name	Scientific name	RF%	RD%	RA%	IVI
1	Asam-lota	*Mikania micrantha* (L.) Kunth	26.73	12.32	15.16	54.21
2	Assamlata	*Mikania cordata* (Burm.f.) B.L.Rob.	22.83	10.91	13.42	47.16
3	Bish Alu	*Dioscorea hispida* Dennst.	2.54	5.42	4	11.96
4	Boro bet	*Calamus viminalis* Willd.	2.69	5.91	4.21	12.81
5	Dudh alu	*Dioscorea bulbifera* L.	2.54	5.42	4	11.96
6	Gandha-vadali	*Paederia foetida* L.	27.03	25.03	29.47	81.53
7	Jali bet	*Calamus tenuis* Roxb.	2.83	6.4	5.42	14.65
8	Maitta Alu	*Dioscorea esculenta* (Lour.) Burkill	2.54	5.42	7.06	15.02
9	Mikeful	*Allamanda cathartica* L.	2.69	5.91	4.21	12.81
10	Sada lajibati	*Mimosa diplotricha* Sauv.	2.69	5.91	4.21	12.81
11	Sal lata, Chehul	*Bauhinia vahlii* Wight & Arn.	2.2	5.44	4.63	12.27
12	Toktoki kanta	*Ziziphus oenoplia* (L.) Mill.	2.69	5.91	4.21	12.81

The goal of the current study was to evaluate the IVI of flora in the Dokhola village of Madhupur Sal forest. According to the study, Madhupur Sal forest differs significantly in terms of stand structure, variety, and composition. Gratifyingly, the IVI of plant species computed in the current findings revealed that *S. robusta* has the highest value which is almost identical to Malaker *et al.* (2008). But previously, approximately 80% of the forests were covered by Sal trees; however, this has rapidly diminished as a result of illegal and unplanned Sal coppice felling, overpopulation, and poverty (Gain 2006).

According to the earlier research of various experts on Sal forests (Gain 2006, Malaker *et al.* 2008), Madhupur Sal forest was richer in species than the current study. The number of tree species found in this study was less than the number reported by several researchers in other Sal forests in India and Nepal. For instance, Sukumar *et al.* (1992) found 71 species in semi-evergreen, moist deciduous, and dry deciduous forests in India, while Kushwaha and Nandy (2012) found 247 and 76 species in moist and dry 12 sal forests. Reddy *et al.* (2007) discovered 88 and 187 species in the moist deciduous Sal forests, respectively. Rahman *et al.* (2016) identified 52 tree species in Kaptai National Park. It should be noted that the base area and stand density of these parks do not accurately reflect the typical forest properties. Whole woodland or bare areas were completely disregarded during data collecting, and only sample plots with the least amount of tree cover were taken into account for data analysis. Jubair *et al.* (2023) found that the variety of plant species in Sal woodland of Bangladesh is progressively declining. This current finding also dictated to the shrunken diversity in Sal Forest of Madhupur while comparing with previous studies.

At the research site, 50 respondents were randomly selected, and a structured interview was conducted to gather information on the ethnobotanical use of forest flora and their perceptions on strategies to mitigate the decline in plant diversity (Tables 5-7). Table 5 revealed that the informants were from the various sectors of livelihood such as farmers (20%), day laborers (20%), housewives (20%), botanists (20%) and traditional herbalists (20%) who were residents to the nearby areas. The results of the survey indicated that 66% of the population in the study region gathers forest flora for various uses. The majority of them gather forest flora for the purpose of trading timber, fuel wood, foods and research and plants for their therapeutic properties (Table 6).

Table 5. Distribution of opinions on flora collection among different respondent groups in madhupur sal forest.

Type of respondent	No. of respondents	% of respondents	Opinion about collection of flora in online			
			Positive		Negative	
			No.	%	No.	%
Farmer	10	20	8	80	2	20
Day labor	10	20	9	90	1	10
House wives	10	20	5	50	5	50
Botanists	10	20	2	20	8	80
Traditional herbalists	10	20	9	90	1	10
Total	50	100.0	33	66	17	34

As a result of the collection of plants, the biodiversity of the forest declines. Additionally, the survey revealed that the highest rate of forest flora usage (90%) occurs among day laborers and traditional herbalists. In contrast, botanists prioritize conservation and less damaging activity to limit biodiversity loss, which is the reason they use a minimum of 20% of forest vegetation. In order to conduct research, botanists would prefer to cultivate plants without compromising plant diversity. Madhupur harbors to diverse flora, where a substantial population both directly and indirectly contributes to the emergence of their livelihood (Rahman *et al.* 2019). In and around the forest, alien species plantations have disrupted the natural forest flora due to growing community growth within the forest region. Consequently, the population of natural associates of Sal is also altering or declining (Rahman *et al.* 2019).

Table 6. List of flora along with the family names and their uses recorded from Madhupur sal forest.

SI. No.	Local name	Scientific name	Family	Uses
1	Ajuli	*Dellinia pentagyna* Roxb.	Dilleniaceae	Fd, T
2	Akando	*Calotropis gigantea* (L.) R. Br.	Apocynaceae	M
3	Akashmoni	*Acacia auriculiformis* A.Cunn. ex Benth	Fabaceae	F, T
4	Am/Mango	*Mangifera indica* L.	Anacardiaceae	F, Fd, T
5	Amloki	*Phyllanthus emblica* L.	Phyllanthaceae	F, Fd, M
6	Arjun	*Terminalia arjuna* (Roxb.) Wight & Arn.	Combretaceae	M
7	Asam-lota	*Mikania micrantha* (L.) Kunth ex H.B.K.	Asteraceae	M
8	Assamlata	*Mikania cordata* (Burm. f.) Robinson	Asteraceae	Fd, M
9	Aswath	*Ficus religiosa* L.	Moraceae	Fd, M
10	Bajna	*Zanthoxylum rhetsa* (Roxb.) DC.	Rutaceae	M, N, T
11	Barokukshim	*Blumea lacera* (Burm. f.) DC.	Asteraceae	M, N
12	Basok	*Justicia adhatoda* L.	Acanthaceae	M
13	Bel	*Aegle marmelos* (L.) Correa	Rutaceae	Fd, M
14	Bet	*Schumannianthus dichotomus* (Roxb.) Gagnep.	Marantaceae	F, T, N
15	Bhat	*Clerodendrum infortunatum* L.	Lamiaceae	M
16	Bish Alu	*Dioscorea hispida* Dennst.	Dioscoreaceae	M
17	Bohera	*Terminalia bellirica* (Gaertn.) Roxb.	Combretaceae	M
18	Bon Begun	*Solanum torvum* Sw.	Solanaceae	Fd
19	Boro bet	*Calamus viminalis* Willd.	Arecaceae	N
20	Bot	*Ficus benghalensis* L.	Moraceae	Fd, M, N
21	Chakunda	*Senna tora* (L.) Roxb.	Caesalpiniaceae	M, N
22	Chatim	*Alstonia scholaris* (L.) R. Br.	Apocynaceae	M, T, N
23	Chesra koroi	*Albizia chinensis* (Osb.) Merr.	Mimosaceae	Fd, N, T
24	Chitki	*Phyllanthus reticulatus* Poir.	Phyllanthaceae	Fd
25	Datai	*Microcos paniculata* L.	Malvaceae	M
26	Debdaru	*Polyalthia longifolia* (Sonn.) Benth. & Hook.f. ex Thwaites	Annonaceae	T
27	Dholpata, Kanchira	*Commelina benghalensis* L.	Commelinaceae	F, Fd
28	Dudh alu	*Dioscorea bulbifera* L.	Dioscoreaceae	Fd
29	Dudh-kuruch	*Wrightia arborea* (Dennst.) Mabb.	Apocynaceae	M
30	Dumur	*Ficus carica* L.	Moraceae	M, Fd, N
31	Fulkhori	*Ageratum conyzoides* L.	Asteraceae	M
32	Gadila	*Careya arborea* Roxb.	Lecythidaceae	M, Fd
33	Gandha-vadali	*Paederia foetida* L.	Rubiaceae	M, Fd
34	Halud krisnachura	*Peltophorum pterocarpum* (DC.) K. Heyne	Caesalpiniaceae	Fd, N, T
35	Horitoki	*Terminalia chebula* Retz.	Combretaceae	M
36	Jagatmadan	*Justicia gendarussa* Burm. f.	Acanthaceae	M
37	Jali bet	*Calamus tenuis* Roxb.	Arecaceae	Fd, N
38	Jam	*Syzygium cumini* L.	Myrtaceae	Fd, T

39	Jamal gota	*Croton tiglium* L.	Euphorbiaceae	M, N
40	Jarul	*Lagerstroemia speciosa* (L.) Pers.	Lythraceae	N, T
41	Jiga/Jeol	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Fd
42	Jongle Ol	*Amorphophallus bulbifer* (Roxb.) Blume	Araceae	Fd
43	Jongli Ada, Bon ada	*Zingiber roseum* (Roxb.) Rosc.	Zingiberaceae	M
44	Jongliboroi	*Ziziphus rugosa* Lam.	Rhamnaceae	Fd, M
45	Kadam	*Anthocephalus cadamba* (Roxb.) Miq.	Rubiaceae	F, Fd, N
46	Kala Koroi	*Albizia lebbeck* (L.) Benth.	Mimosaceae	Fd, M, N, T
47	Kalokeshi, Banda-banda	*Eclipta alba* (L.) Hassk	Asteraceae	M
48	Kan sonalu	*Stereospermum suaveolens* (Roxb.) DC.	Bignoniaceae	M, N
49	Kanchan	*Bauhinia variegata* L.	Fabaceae	F, Nk
50	Kanjal Bhadi	*Bischofia javanica* Blume	Euphorbiaceae	M, T
51	Khejur	*Phoenix sylvestris* Roxb.	Arecaceae	Fd, M, N
52	Kolaful	*Canna indica* L.	Commelinaceae	M, N
53	Krisnachura	*Delonix regia* Rafin.	Caesalpiniaceae	N
54	Kurch/Kuruj	*Holarrhena pubescens* Wall. ex G. Don	Apocynaceae	M
55	Lajibati	*Mimosa pudica* L.	Mimosaceae	M
56	Lohakat	*Xylia kerrii* Craib & Hutch.	Fabaceae	T
57	Mahagoni	*Swietenia mahagoni* Jacq.	Meliaceae	N
58	Maitta Alu	*Dioscorea esculenta* (Lour.) Burkill	Dioscoreaceae	Fd, M
59	Mandar	*Erythrina variegata* L.	Fabaceae	M
60	Mikeful	*Allamanda cathartica* L.	Apocynaceae	M, N
61	Monkata	*Randia dumetorum* (Retz.) Poir.	Rubiaceae	M
62	Motkila	*Glycosmis pentaphylla* (Retz.) DC.	Rutaceae	M
63	Muchonda	*Mussaenda roxburghii* Hook. f.	Rubiaceae	N
64	Neem	*Azadirachta indica* A. Juss.	Meliaceae	M, T, N
65	Palash	*Butea monosperma* (Lamk.) Taub.	Fabaceae	Fd, M, N
66	Pitraj	*Aphanamixis polystachya* (Wall.) R. Parker	Meliaceae	T
67	Raintree	*Samanea saman* (Jacq.) Merr.	Mimosaceae	F, Fd, N, T
68	Raj koroi	*Albizia richardiana* (Voigt.) King & Prain	Mimosaceae	N, T
69	Ranggula	*Bixa orellana* L.	Bixaceae	M, N
70	Sada lajibati, Bara lajibati	*Mimosa diplotricha* C. Wright ex Sauv.	Mimosaceae	N
71	Sal	*Shorea robusta* C.F. Gaertn.	Dipterocarpaceae	T
72	Sal lata, Chehul	*Bauhinia vahlii* Wight & Arn	Caesalpiniaceae	M, N
73	Sheora	*Streblus asper* Lour.	Moraceae	M
74	Shial lata, Dankuni	*Vernonia cinerea* (L.) Less	Asteraceae	Fd
75	Shil koroi	*Albizia procera* (Roxb.) Benth.	Fabaceae	T
76	Shimul	*Bombax ceiba* L.	Bombacaceae	M, N
77	Sinduri	*Mallotus philippensis* (Lam.) Müll. Arg.	Euphorbiaceae	T
78	Sonalu, Banor noli	*Cassia fistula* L.	Caesalpiniaceae	Fd, M, N, T
79	Tetul	*Tamarindus indica* L.	Fabaceae	Fd, M
80	Thankuni	*Centella asiatica* (L.) Urban	Apiaceae	Fd, M
81	Toktoki kanta, Tokni boroi	*Ziziphus oenoplia* (L.) Mill.	Rhamnaceae	Fd
82	Tujha	*Thuja orientalis* L.	Cupressaceae	M, N
83	Ulatkombol	*Abroma augusta* L.	Malvaceae	M

F: Fuelwood, Fd: Food/Fodder, M: Medicine, N: Miscellaneous, Nk: Not known, T: Timber

Table 7 illustrates the survey results addressing the opinions of respondents on how to solve problems with the current management system and plant diversity protection. These opinions were organized by the authors in structural interview method. Table 7 was designed with the consent of the local respondents. According to all of the respondents, awareness campaigns should be conducted to educate the public about the value of biodiversity and forest areas for the social, ecological, and environmental circumstances of human life as well as exploitation of forest resources should be prevented by modernizing forest management policies. Moreover, according to Table 7, about 60% of respondents affirmed that sustainable use of some resources, such as vegetables, honey, medicinal plants, and other non-timber forest products, may be permitted given local reliance on forest resources. Additionally, 20% of respondents agreed that illegal clear-cutting and forest plant collection ought to cease and that native plant species should be planted in excess of exotic ones. According to Corlett (2016), through the next few decades of fast world change, all terrestrial plant species should be safeguarded by completing the inventories, conservation status assessment, improving the protected area system, controlling overexploitation and ex-situ conservation. To lessen human demands on the natural resources of Sal Forest and to support the needs of indigenous resident for a living, protection measures and eco-development initiatives are required. In order to preserve the natural balance of the forests and conserve the dominant tree species required for canopy development, a comprehensive strategy to forest management is required (Jubair *et al.* 2023). The suggested measures in this study could aid administrators in reducing the loss of diversity.

Table 7. Opinions of the respondents regarding minimization of the loss of plant diversity.

SI. No.	Categories of solution	No. of respondents	Percentage (%)
1.	The unlawful consumption of forest products should be stopped by modernizing forest management through forest master plans, acts and regulations that involve local participation alongside with constructing inventories, ex-situ conservation and controlling climatic change.	50	100
2.	Activities aimed at raising awareness should be conducted to help people to minimize overexploitation as well as to realize the value of forests and biodiversity in the social, economic, ecological, and environmental contexts of human existence.	50	100
3.	In order to preserve the plant diversity of the forest, cutting down trees should be avoided at all costs.	10	20
4.	Short-rotation plantations with exotic trees ought to be gradually replaced with native species.	10	20
5.	The sustainable use of some resources, such as vegetables, honey, medicinal plants, and other non-timber forest products, may be permitted given the local reliance on forest resources.	30	60

In conclusion, the highest density, frequency, abundance and IVI of tree species among the structural makeup of the Dokhola village of Madhupur Sal forest has been determined to be in Sal. Furthermore, a wide diversity of shrubs, herbs, and tree species can be found in this studied region. This forest must be preserved in order to support the local population's fundamental requirements as well as to preserve their rich biodiversity. Besides, by providing a baseline for the description of plant diversity in Bangladeshi Sal forests, this study can shed light on the condition of species dominance and richness in highly diverse area with plants. The results of this study can also help administrators create plans for biodiversity protection by highlighting the significance of a well-balanced distribution of entire Sal forests. In order to preserve biological diversity, this study urges the creation of an immediate conservation strategy.

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