

Wetland Plants and their Ethnobotanical Uses in Raja-Rani Tal, Letang, Morang, Nepal

Kalpna Sharma (Dhakal)^{1*}, Dammar Singh Saud¹, Krishna Ram Bhattarai¹, Amrit KC², Sajita Dhakal² and Madan Kumar Khadka¹

¹Department of Plant Resources, Thapathali, Kathmandu

²National Herbarium and Plant Laboratories, Godawari, Lalitpur

*E-mail: kalpanasharmadhakal@gmail.com

Abstract

Wetland plants play vital role in ecosystems and also provide various basic needs such as food, medicine, fodder, green manure, raw materials etc. A total of 108 plant species were documented from the wetland and periphery of Raja-Rani Tal, Morang in April and December 2018. We documented angiosperms (Dicots 48, Monocots 32), Pteridophytes 10, Bryophytes 1, and algae 17 species, belonging to 91 genera and 56 families. Among the total species, 70 species are hydrophytes including algae having the different growth form like Emergent (43) > Floating (5) > Floating-Leaved (3) > Submerged (2) while 43 species are found around the periphery of wetland. There were 77 species native including one endemic flowering plant species, and 12 species exotic including 6 invasive alien species. These wetland plants were used by local people for fodder (31), medicine (7), fermenting agent (3), vegetable (3), beekeeping (2), compost (1), fish poison (1), ripening (1), cultural use.

Keywords: Exotic, Growth form, Macrophytes, Native, Use

Introduction

Wetland plants are those plants that normally grow in or on the water or where soils are flooded or saturated long enough for anaerobic condition to develop in the root zone (Cronk & Fennessy, 2009). They are also known as hydrophytes. Thousands of plant species grow in wetlands, ranging from algae, mosses and grass to shrub and trees. The richness of plant species in aquatic and wetland habitats is relatively low compared with most terrestrial communities (Richardson & Vymazal, 2001). Most are rooted, but a few species float freely in the water. There are 318 wetland dependent plant species in Tarai region of Nepal which include 6 climbers, 287 herb, 9 shrub and 16 tree species (Siwakoti, 2006). Wetland plants play several vital roles in wetland ecosystems as they are the base of food chain, and provide critical habitat for other taxonomic groups, such as bacteria, epiphyton (algae that grow on the surface of plants), macro invertebrates, fish, and birds. Beside these roles, wetland plants also provide various basic needs such as food, medicine, fodder, green manure, raw materials etc. (Siwakoti, 2006; Dangol, 2014).

Wetlands are considered to be one of the most threatened of all major natural ecosystems. Similarly, the ethnobotanical knowledge and practices are also in danger of being lost in country. Therefore, effort should be made to document the wetland plants and their ethnobotanical uses before the extinction of these useful plants and their associated knowledge. Some studies on documentation of wetland flora and their use have been conducted in some wetlands of Morang districts (Niroula & Singh, 2010; Koirala & Jha, 2011).

The Raja- Rani Tal is a very important wetland in the Chure region of the eastern Nepal due to its biodiversity, environmental and cultural values. It was recommended to explore the possibility to designate the wetland as a Ramsar Site and found two Ramsar criteria qualifying to this wetland (Siwakoti et al., 2012). Enumeration of orchid species and algal flora (Chlorophyceae) species has been done in Raja-Rani wetland. Shakya & Bajracharya (2005) recorded 45 orchid species from Raja-Rani wetland with most of the species in good number, whereas, Godar & Rai (2018) reported 72 freshwater chlorophycean algae belonging to 33

genera, 12 families and 7 orders from Raja-Rani wetland. We documented few algal species, bryophytes, pteridophytes and angiosperm from the Raja-Rani wetland and their ethnobotanical uses from the Magar community residing in Letang village.

Materials and Methods

Study area

Raja-Rani wetland (26°44'53"N and 87°28'54"E, 467 m asl) situated along the Chure hill range in Letang Municipality-1, Morang district, Nepal (Figure 1). It is located in north-west from Letang Danda surrounded by mixed forest of *Shorea robusta*, *Cassia fistulosa*, *Syzygium cuminii* etc. The wetland cover three ponds named as Raja, Rani and Chori. The largest one is Raja Pokhari which is located in the western side having the depth of 7 m. in rainy and 3 m. in winter and 2 m. in summer season. The Rani Pokhari located in eastern side and Chori in north eastern side which is almost dried in condition. Nearby settlement of wetland is dominated by Magar community. This wetland has been managed by Raja Rani Community Forest User's Group. The three lakes cover about 20 ha of land along the catchment area of about 133 ha. It feeds by ground source "Jaruwa", seasonal forest fed streams and direct precipitation (Godar & Rai, 2018). Some Tree species in surroundings of Raja Rani wetland are *Albizia* sp., *Alstonia scholaris*, *Castanopsis indica*, *Cassia fistula*, *Mallotus phillipensis*, *Schima wallichii*, *Shorea robusta*, *Syzygium cuminii*, *Sterculia* sp., *Trewia nudiflora* etc.

Field visit and data collection

Two field trips were done in April and December 2018 for the study. The hydrophytes specimens and their photographs were collected from wetland as well as other macrophytes from the surroundings up to 5 m from the periphery of the wetland. Some plants were identified in field and unidentified plants were collected, prepared herbarium and identified by comparing it with deposited herbarium at National Herbarium and Plant Laboratories (KATH), Godawari, Lalitpur, Nepal and housed at KATH. <http://www.theplantlist.org> was followed for

nomenclature. On the basis of their growth form, hydrophytes excluding algae are classified as submerged, floating, floating-leaved and emergent (Materac & Sobiecka, 2017).

- 1) Submerged: These plants usually grow under water and are rooted in mud.
- 2) Floating-Leaved: Their leaves are floating on the water surface, and they contain anchoring roots on the surface of soil.
- 3) Floating: The stem and leaves of these plants float, they submerged in water without any attachment to the sediment.
- 4) Emergent: These plants spread their shoots and leaves above the water, while keeping their roots beneath the surface.

Other angiospermic plants collected from periphery of the wetland are classified as tree, shrub, herb, climber, creeper. Similarly, pteridophytes are classified asepiphytic, terrestrial and creeping.

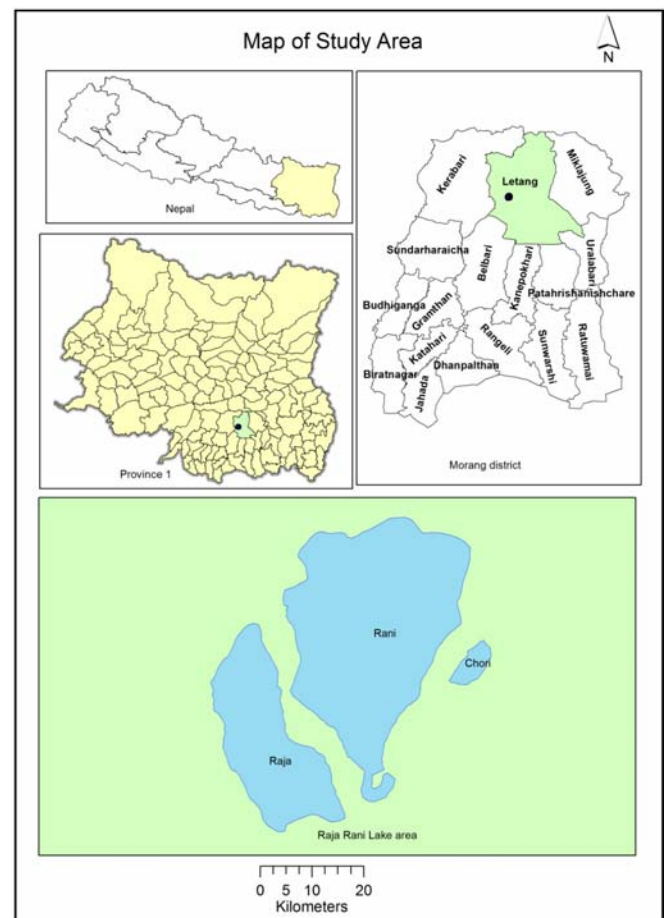


Figure1: Map of study sites.

Plant categorization

Plants were classified into the categories of native, exotic on the basis of its origin by consulting Global Register of Introduced and Invasive Species-Nepal (Shrestha et al., 2019) and for invasive plant (Shrestha et al., 2017).

Ethnobotanical data collection

Ethnobotanical data of wetland plants were collected from the Magar community residing nearby the wetland. Questionnaires were prepared for interviews and informants were chosen randomly. Prior to interview, the purpose of research background was explained to each informant. Ethnobotanical data of wetland plants were collected through interview with local people and key informants. During the interview, collected plants or photographs were shown.

Results and Discussion

Species diversity

Altogether 108 plant species were documented from the wetland and around the periphery of wetland comprising angiosperms (Dicots 48, Monocots 32), Pteridophytes 10, Bryophytes 1, and algae 17, belonging to 91 genera and 56 families (Table 1 and Figure 2). Among the total species, 70 species are hydrophytes including algae while 43 species are found around the periphery of wetland. 77 species were native including one endemic flowering plant species, 12 species were exotic including six invasive alien species. Koirala & Jha (2011) had reported 149 species of macrophytes from the low

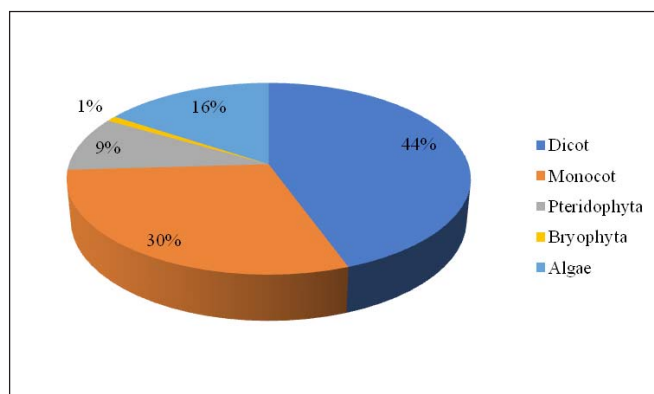


Figure 2: Species diversity in different taxonomic groups

land wetlands of Morang which compromise Angiosperms (dicots 60, monocots 78), Pteridophytes 7, Bryophytes 2, and algae 2. Similarly, Niroula & Singh (2011) reported 84 aquatic plant species belonging to 71 genera and 41 families from the Betana wetland, Morang. This show high diversity of macrophytes in Raja-Rani wetland. One of the endemic species (*Eriocaulon exsertum*) has been reported from this wetland.

Growth form

The growth forms of the hydrophytes excluding algae recorded in the present study were Emergent (43) > Floating (5) > Floating-Leaved (3) > Submerged (2) (Figure 3). Similarly the growth form of Angiospermic plant around the periphery of wetland were Shrub (14) > Herb (10) > Climber (6) > Tree (2) like-wise the growth form of pteridophytes were Terrestrial (3) > Epiphytic (1), Creeping (1) and Climber (1). As in findings of Burlakoti & Karmacharya (2004) and Dangol et al. (2014) the emergent species were higher in number which is followed by Floating, Floating-leaved and Submerged. The aquatic tree species *Cephalanthus tetrandra* has covered about one third of Rani Tal also in some portion in Raja Tal. Higher the number and dominance of emergent species may be the indicator of the wetland sedimentation reducing the core area of the lake and showing the trend of succession towards marsh meadow condition.

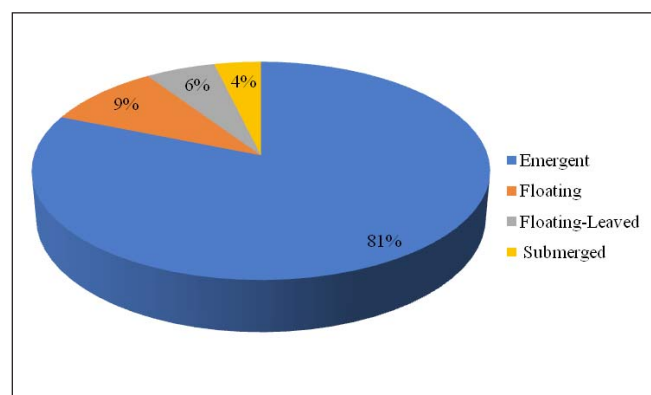


Figure 3: Growth forms of the hydrophytes

Ethnobotanical use

The local Magar communities residing near the wetland interviewed about the use of wetland plants.

They use 31 dicot plants and 16 monocot plants for different purpose like for Fodder (31), Medicine (7), Fermenting agent (3), Vegetable (3), Beekeeping (2), Compost (1), Fish poison (1), Ripening (1), Cultural use (1), Local tools (1). They use stem of 34 species, leaves of 33 species, Root of 6 species, Flower of 4 species, Fruit of 3 species, latex of 2 species, tuber of 1 species and young shoot of 2 species and whole plants of 1 species.

Conclusion

The presence of wide diversity and locally important plants, as well as endemic plants in the wetland, reveal that the wetland is ecologically important. The intrusion of invasive species like *Eichhornia crassipes* and *Pistia stratiotes* threatening the wetland plants. The study had recorded one endemic species in small patch. The conservation of this plant is our duty. So for the conservation of such important species the local community should be made aware for restoration and sustainable conservation of wetland to reduce the eutrophication and succession rate.

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Table 1: Wetland Plants and their ethnobotanical uses

S. N.	Family	Scientific Name	Growth Form	Parts Used	Uses	Collection No.	IUCN Conservation Status	Native/exotic
	Algae							
1	Desmidiaceae	<i>Closterium diana</i> Ehrenberg ex Ralfs						
2	Desmidiaceae	<i>Closterium gracile</i> Brébisson ex Ralfs						
3	Desmidiaceae	<i>Cosmarium pyramidatum</i> Brébisson ex Ralfs						
4	Desmidiaceae	<i>Cosmarium</i> sp.						
5	Desmidiaceae	<i>Cosmarium speciosum</i> P.Lundell						
6	Desmidiaceae	<i>Euastrum turneri</i> West						
7	Desmidiaceae	<i>Micrasterias foliacea</i> Bailey ex Ralfs						
8	Desmidiaceae	<i>Pleurotaenium baculoides</i> (J.Roy & Bisset) Playfair						
9	Desmidiaceae	<i>Staurastrum</i> cf <i>margaritaceum</i> Meneghini ex Ralfs						
10	Desmidiaceae	<i>Staurastrum</i> sp.						
11	Euglenidae	<i>Euglena gracilis</i> G.A.Klebs						
12	Nostocaceae	<i>Anabaena</i> sp.						
13	Oscillatoriaceae	<i>Oscillatoria</i> sp.						
14	Oscillatoriaceae	<i>Phormidium</i> sp.						
15	Phacidae	<i>Phacus</i> sp.						
16	Scenedesmaceae	<i>Scenedesmus acutiformis</i> Schröder						
17	Spirulinaceae	<i>Spirulina</i> sp.						
	Bryophyta							
1	Ricciaceae	<i>Riccia fluitans</i> L.	F				LC	Na
	Pteridophytes							
1	Pteridaceae	<i>Onychium siliculosum</i> (Desv.) C. Chr.	Terrestrial			RJ0054		Na
2	Pteridaceae	<i>Pteris biaurita</i> L.	Terrestrial	Rhizome	Paste is applied in sprain and fracture	RJ0042/L2		Na
3	Thelypteridaceae	<i>Cyclosorus interruptus</i> (Willd.) H. Ito	E			RN034	LC	Na
4	Pteridaceae	<i>Adiantum lunulatum</i> Burm. f.	E			RN013		Na
5	Dennstaedtiaceae	<i>Microlepia setosa</i> Alston	E	Leaves	Used as cattle bed	RJ0041		Na
6	Dennstaedtiaceae	<i>Microlepia speluncae</i> (L.) T. Moore	Terrestrial			RJ0047/L38		Na
7	Lycopodiaceae	<i>Lycopodiella cernua</i> (L.) Pic. Serm.	Creeping			RJ0034/L12	LC	Na
8	Lygodiaceae	<i>Lygodium flexuosum</i> (L.) Sw.	Climber	Rhizome	Paste is applied on wound.	RJ0043		Na
9	Polypodiaceae	<i>Microsorium punctatum</i> (L.) Copel.	Epiphytic	Leaves	Fodder	RJ0012		Na
10	Salviniaceae	<i>Azolla pinnata</i> R.Br.subsp. <i>Asiatica</i> R.M. K. Saunders & K. Fowler	F			RJ0100		Na
	Angiosperms							
	Dicotyledons							
1	Amaranthaceae	<i>Achyranthes bidentata</i> Blume	E	Stem, leaves	Fodder	RJ0011		Na
2	Lauraceae	<i>Actinodaphne gullavara</i> (Buch.-Ham. ex Nees) M.R.Almeida	Tree			L39,RJ0062		Na
3	Compositae	<i>Adenostemma lavenia</i> (L.) Kuntze	Herb			RJ0046		Na
4	Amaranthaceae	<i>Alternanthera sessilis</i> (L.) R.Br. ex DC.	E	Stem, leaves	Fodder	RJ0026	LC	Ex
5	Primulaceae	<i>Ardisia solanacea</i> (Poir.) Roxb.	Shrub			RJ0050		Na
6	Convolvulaceae	<i>Argyrea hookeri</i> C. B. Clarke	Climber			RJ0009		Na
7	Acanthaceae	<i>Barleria cristata</i> L.	Shrub	Stem, leaves	Fodder	RJ0006		Na
8	Compositae	<i>Bidens pilosa</i> L.	E	Stem, leaves	Fodder	RN024		Ex (Invasive)
9	Urticaceae	<i>Boehmeria macrophylla</i> Hornem.	Herb			RN018		Na
10	Lamiaceae	<i>Callicarpa macrophylla</i> Vahl	Herb	Root, fruit	Paste is eaten against gastritis and in fever	RJ0039	LC	Na

S. N.	Family	Scientific Name	Growth Form	Parts Used	Uses	Collection No.	IUCN Conservation Status	Native/exotic
11	Celastraceae	<i>Celastrus</i> sp.	E			RJ0057		Na
12	Rubiaceae	<i>Cephalanthus tetrandra</i> (Roxb.) Ridsdale & Bakh.f.	E			RJPh2		Na
13	Compositae	<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	Shrub	Whole plant	Used to make compost.	RJ0044		Ex (Invasive)
14	Lamiaceae	<i>Clerodendrum bracteatum</i> Wall. ex Walp.	Shrub	Stem, leaves	Fodder for pigs only.	RJ0058		Na
15	Lamiaceae	<i>Colebrookea oppositifolia</i> Sm.	Shrub	Leaves; flower	Used for ripening of banana, useful for bee keeping	RJ0053		Na
16	Leguminosae	<i>Crotalaria alata</i> D.Don	E			RJ0004		Na
17	Compositae	<i>Eclipta prostrata</i> (L.) L.	E	Leaves	Paste is applied in cut and wounds	RJ0040	LC	Ex
18	Compositae	<i>Elephantopus scaber</i> L.	E	Root	Paste is used as fermenting agent	RJ0016		Na
19	Compositae	<i>Emilia sonchifolia</i> (L.) DC. ex DC.	E	Root, stem	Paste is used as fermenting agent	RJ0005		Na
20	Acanthaceae	<i>Eranthemum pulchellum</i> Andrews	E	Stem, leaves	Fodder	RJ0018		Na
21	Euphorbiaceae	<i>Euphorbia hirta</i> L.	E	Stem, leaves, latex	Fodder; latex is used in cut and wound and in opaqueness of eye of cattle.	RN029		Ex
22	Leguminosae	<i>Flemingia strobilifera</i> (L.) W.T.Aiton	Shrub	Stem, leaves	Fodder	RJ0048		Na
23	Compositae	<i>Gnaphalium</i> sp.	Herb	Stem, leaves	Fodder	RJ0030		Na
24	Apocynaceae	<i>Ichnocarpus frutescens</i> (L.) W.T.Aiton	Climber			RN016		Na
25	Compositae	<i>Inula cappa</i> (Buch.-Ham. ex D.Don) DC	Shrub	Flower	Flower is used as fermenting agent	RJ0017		Na
26	Rubiaceae	<i>Knoxia sumatrensis</i> (Retz.) DC.	Herb			RJ0035		Na
27	Vitaceae	<i>Leea macrophylla</i> Roxb. ex Hornem.	Shrub	Leaves	Fodder	RJ0036		Na
28	Onagraceae	<i>Ludwigia perennis</i> L.	E	Stem, leaves	Fodder	RJ0021	LC	Na
29	Primulaceae	<i>Maesa chisia</i> Buch.-Ham. ex D. Don	Tree	leaves, fruit	Fodder, fruit paste is applied on skin of hand and legs for good looks.	RJ0055		Na
30	Leguminosae	<i>Millettia fruticosa</i> (DC.) Baker	Shrub			RJ0052	DD	Na
31	Compositae	<i>Mikania micrantha</i> Kunth	Climber	Stem, leaves	Fodder, flower is useful for honey bee to make honey	RJ0010		Ex (Invasive)
32	Leguminosae	<i>Mimosa pudica</i> L.	Shrub	Root	paste is eaten to cure throat ache; applied on wound.	RN022		Ex (Invasive)
33	Nelumbonaceae	<i>Nelumbo nucifera</i> Gaertn.	FL			RJPh3		Na
34	Menyanthaceae	<i>Nymphoides hydrophylla</i> (Lour.) Kuntze	FL			RN005	LC	Na
35	Apiaceae	<i>Oenanthe javanica</i> (Blume) DC.	E	Stem, leaves	Fodder	RJ0007	LC	Na
36	Polygonaceae	<i>Persicaria barbata</i> (L.) H.Hara	E			L19	LC	Na
37	Polygonaceae	<i>Persicaria hydropiper</i> (L.) Delarbre	E	Root, stem	Paste is used as fish poison for fishing	RJ0022	LC	Na
38	Piperaceae	<i>Piper longum</i> L.	Climber	Stem, leaves	Fodder	RJ0023		Na
39	Lamiaceae	<i>Pogostemon benghalensis</i> (Burm.f.) Kuntze	Herb			RJ0059		Na
40	Linaceae	<i>Reinwardtia indica</i> Dumort.	Shrub			RN009		Na
41	Lythraceae	<i>Rotala indica</i> (Willd.) Koehne	E			RN003	LC	Na
42	Acanthaceae	<i>Rungia pectinata</i> (L.) Nees	E	Stem, leaves	Fodder	RJ0027		Na

S. N.	Family	Scientific Name	Growth Form	Parts Used	Uses	Collection No.	IUCN Conservation Status	Native/exotic
43	Plantaginaceae	<i>Scoparia dulcis</i> L.	Herb			RN026		Ex
44	Malvaceae	<i>Sida cordata</i> (Burm.f.) Bors. Waalk.	Shrub	Young shoot	Used as vegetable	RN023		Ex
45	Rubiaceae	<i>Spermacoce alata</i> Aubl.	Herb	Stem, leaves	Fodder	RJ0045		Ex. (Invasive)
46	Menispermaceae	<i>Stephania japonica</i> (Thunb.) Miers	Climber	Root	Paste is eaten against gastritis and stomach problems	RJ0025		Na
47	Acanthaceae	<i>Strobilanthes abbreviata</i> Y.F. Deng & J.R.I. Wood	Shrub	Stem, leaves	Fodder	RJ0014		Na
48	Malvaceae	<i>Urena lobata</i> L.	Shrub	Leaves, stem	Fodder	RJ0037		Na
	Monocotyledons							
1	Commelinaceae	<i>Commelina</i> sp.	E	Stem, leaves	Fodder, young leaves are used as vegetable	RJ0033		
2	Cyperaceae	<i>Courtoisina cyperoides</i> (Roxb.) Sojak	E			L7	LC	Na
3	Cyperaceae	<i>Cyperus platystylis</i> R.Br.	E			L24		Na
4	Cyperaceae	<i>Cyperus corymbosus</i> Rottb.	E			RJ0032		Na
5	Cyperaceae	<i>Cyperus esculentus</i> L.	E			RJ0038	LC	Na
6	Cyperaceae	<i>Cyperus pilosus</i> Vahl	E			RN032	LC	Na
7	Poaceae	<i>Dichantherium</i> sp.	E			RN012		Na
8	Poaceae	<i>Digitaria longiflora</i> (Retz.) Pers.	E			L20		Na
9	Pontederiaceae	<i>Eichhornia crassipes</i> (Mart.) Solms	F			RJ0003		Ex
10	Eriocaulaceae	<i>Eriocaulon exsertum</i> Satake	E	Stem, leaves	Fodder	RN030		Na. En.
11	Cyperaceae	<i>Fimbristylis aestivalis</i> Vahl	E			L6		Na
12	Cyperaceae	<i>Fimbristylis dichotoma</i> (L.) Vahl	E			RN027	LC	Na
13	Commelinaceae	<i>Floscopa scandens</i> Lour.	E	Whole plant	Fodder	RJ0013	LC	Na
14	Poaceae	<i>Hymenachne amplexicaulis</i> (Rudge) Nees	E	Stem, leaves	Fodder	RN004		Na
15	Poaceae	<i>Isachne</i> sp.	E	Stem, leaves	Fodder	RN006		Na
16	Juncaceae	<i>Juncus</i> sp.	E	Stem, leaves	Fodder	RJ0015		Na
17	Juncaceae	<i>Juncus</i> sp.	E			RN031		Na
18	Juncaceae	<i>Juncus</i> sp.	E			RN033		Na
19	Zingiberaceae	<i>Kaempferia rotunda</i> L.	Herb	Tuber	Paste is applied to cure fracture	RN019		Na.
20	Araceae	<i>Lasia spinosa</i> (L.) Thwaites	E	Young shoot	Used as vegetable	RN008/L27	LC	Na
21	Apiaceae	<i>Oenanthe javanica</i> (Blume) DC.	E	Stem, leaves	Fodder	RJ0007	LC	Na
22	Hydrocharitaceae	<i>Ottelia alismoides</i> (L.) Pers.	S			RJ0001	LC	Na
23	Poaceae	<i>Panicum sumatrense</i> Roth	E	Stem, leaves	Fodder	RJ0061	LC	Na
24	Araceae	<i>Pistia stratiotes</i> L.	FL	Stem, leaves	Fodder for pigs	RN002	LC	Ex (Invasive)
25	Poaceae	<i>Poa annua</i> L.	Herb	Stem, leaves	Fodder	RJ0060		Na
26	Araceae	<i>Pothos chinensis</i> (Raf.) Merr.	Climber	Stem	Used to make local tools <i>nanglo</i>	RJ0049		Na
27	Poaceae	<i>Sacciolepis indica</i> (L.) Chase	E	Stem, leaves	Fodder	RN025		Na
28	Poaceae	<i>Setaria pumila</i> (Poir.) Roem. & Schult.	E	Stem, leaves	Fodder	RN028		Na
29	Smilacaceae	<i>Smilax ovalifolia</i> Roxb. ex D. Don	Climber	Stem	Cultural value; stick to play <i>dhangro</i> used by <i>dhami</i>	RJ0056		Na
30	Hydrocharitaceae	<i>Vallisneria natans</i> (Lour.) H. Hara	S			RN035		Na
31	Pandanaceae	<i>Pandanus furcatus</i> Roxb.	E			RNPh1		Na
32	Araceae	<i>Spirodela polyrrhiza</i> (L.) Schleid.	F					Na

Note: Life forms: E-emergent; FL-floating -leafed; F-floating; S-submerged; Na-Native; Ex-Exotic; LC least concern