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Phytosociological investigation of aquatic macrophytes of five wetlands of Sonitpur district of Assam, India

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ABSTRACT

The Sonitpur district is situated along the north bank of river Brahmaputra between 26^0 30'N to 27^0 02'N Latitudes and 92^0 17'E to 93^0 47'E Longitudes covering an area of 5255.2 km^2 (492145 ha) that accounts for 6.27% of the geographical area of the state. The district is largest district of the state in terms of percentage coverage of wetland areas. This study is conducted to assess the phytosociological status of aquatic macrophytes of Bosasimalu, Borsola, Borakota, Bhedelimora and Gereki wetland of the district during the period of April 2012 to April 2013. All total 228 plant species in different categories under 57 families were recorded and out of which moist soil, ecotone and rooted emergent hydrophytes have found to be dominating macrophytes in the present study. Among the life forms, chamaephytes found to be highest life form followed by hydrophytes and geophytes. The plant species like Alocasia cucullata Schott., Colocasia esculanta (L.), Schott. Eichhornia crassipes Solms-Laub., Hydrilla verticillata (l.F.) Royle., Hymenachne assamica Hitch., Ipomea carnea Jacq. ,Nymphaea nouchali Burn.fsyn.etc have shown predominant during summer and Alocasia indica Schott., Eichhornia crassipes Solms-Laub., Ipomea carnea Jacq., Nymphaea nouchali Burn.fsyn., Saccharum spontaneum L., Sagittaria sagitifolia L. etc have found to be dominating plant species during winter.

Key words: Wetlands, dominant, Phytosociology, macrophytes, life forms.

INTRODUCTION

Wetlands are one of the most valuable ecosystems, providing a number of ecosystems services besides being the repository of many specialised aquatic organisms. But on a global scale, mainly due to anthropogenic cause, wetlands are reducing, degrading and deteriorating its natural characteristics at an alarming rate in the last few decades. As they may also function as important refugia and subsidy for organisms spending most of their life cycle in terrestrial or purely aquatic ecosystems, hence, wetland reduction affects not only pure wetland species, but also the biodiversity of whole regions [1, 2]. Wetland plants grow in soil saturated by water or in water itself [3]. Because of variable hydrology, growth forms that vary within and between wetlands may be emergent, as well as floating, rooted with floating leaves or submerged etc. [4,5] Wetland plant habitats are extremely varied; they may be permanent or temporary, either predictable or unpredictable, fresh water or saline and running or static water [6,7,8]. Aquatic macrophytes have considerable importance in the aquatic trophic levels as well as in the productivity of the wetland ecosystems. They are also pollution indicators of the water bodies [9]. The Aquatic macrophytes diversity has a significant role in understanding the wetland ecosystem dynamics [10]

India has a total of 105, 64.899 ha of wetlands; the total annual ecosystem services value of wetlands is estimated to be 75.04 lakh cores [11]. A total of 5097 wetlands (>2.25 ha) and 6081 small wetlands (<2.25 ha) have been identified in Assam which encompass 764372 ha that is around 9.74 % of the geographic area of the state. River/stream types of wetland encompass 637164 ha, accounting a majority of 84 % of the wetlands followed by lake/pond (51257ha), waterlogged (47141ha) and ox-bow lakes (14173ha). Besides 2833 ha area under man made

wetland is also mapped [12]. Since, 1990, over half of the world's wetlands may have disappeared. Tropical wetlands are increasingly disappearing as a result of development decisions. Such development decisions are taken without considering the loss in wetland benefits arising from damages and conversion of wetlands [13]. India has lost 38% of its wetlands during the period from 1991 to 2001. The trend of degradation and disappearance of wetlands at a rapid pace in Assam is quite noticeable during the recent times.

The value of wetlands and their resources have been accepted over the ages and there has been considerable international effort to conserve wetlands [14]. Therefore, documentation of wetlands in terms of its structure and function is becoming a prerequisite for conservation of wetlands of a region. A few works have been done on the floristic diversity of wetland of Assam [15, 16 17, 18, 19, 20, 21, 10]. Very limited studies have been done on the aquatic flora of wetlands of the Sonitpur district, Assam [22, 23]. The present study, therefore, focuses on the phytosociological aspects of the five wetlands of Sonitpur district, Assam.

Study Area:

Total number of freshwater wetlands in Sonitpur district of Assam is 206 and it constitutes about 3651.00 hectares. The area has an average rainfall of 1900 mm, mainly between the months of May and September [24]. Total wetland area in the district is 83427 ha that includes 980 small wetlands (<2.25 ha). River/stream occupies 94.52% of wetlands. The other major wetland type is Waterlogged - natural (2.22%) and Ox-bow lakes (1.04%). There are 23 Tank/pond types of wetlands covering 84 ha. Most of the wetlands are found to exist in the southern side of the district along the bank of Brahmaputra river. Following five wetlands have been selected for the present study as described below.

Bosasimalu: It is an ox-bow type; open, perennial and unleased wetland lie between $26^0$35′48.88″N latitude and $92^0$24′54.22″E longitude, some 50 km away from the west of Tezpur. The main feeder river of this wetland is Brahmaputra and the wetland is also inundated by the small rivers like Belsiri, Sopai and Panchnoi during summer. It occupies an area of about 25 ha.

Borsola: It is a lake-like; open, semi perennial and leased wetland situated between $26^0$35′46.8″N latitude and $92^0$23′06.0″E longitude in the western side of Tezpur and about 60 km away from it. During flood, the wetland becomes inundated by the river Brahmaputra. It occupies an area of 15 ha. and the buffer zone of the wetland to its western side is completely dominated by human settlement.

Borakota: It is situated on the bank of river Brahmaputra between $26^0$38′47.50″N latitude and $92^0$40′35.80″E longitude. It is a riverine, semi perennial, highly disturbed, open and leased wetland present about 18 km away from the west of Tezpur and covering an area of around 30ha. The hydrology of the wetland is regulated by the river Brahmaputra and Gabharu.

Bhedelimora: This is a riverine, closed and temporary wetland that lie between $26^0$39′45.61″N latitude and $92^0$44′05.98″E longitude and situated on the western side of Tezpur, and about 5kms away from it. It is a vast area covering a landmass of about 25ha. When the Brahmaputra becomes overloaded during the rainy season, the water enters into the Dipota river and then to the wetland through various streamlets.

Gereki: It is an urban riverine, temporary and closed wetland situated on the north bank of Brahmaputra and based on the eastern side of Tezpur between $26^0$37′16.30″N latitude and $92^0$49′′06.80″E longitude. According to the official record, it was, earlier, an open ox-bow type wetland. It occupies an area of 10ha. The water enters into the wetland only when the Brahmaputra overflows and the other sources of water is the river Mora bharali through some artificial channels like culvert, drains etc.

MATERIALS AND METHODS

The coordinates (Latitude and Longitude) of five wetlands of the district have been taken with the help of GPS **(**Model Garmin etrex). In each wetland, macrophytic plant species were recorded and collected. The plant species were pressed between the absorbents under varying degree of pressure at regular intervals immediately after reaching laboratory. Dried specimens were poisoned by Kew mixture (115 gm mercuric chloride dissolved in 4.5 liter ethyl alcohol). After the specimens were poisoned, they were dried and affixed on herbarium sheets (28cm x 42 cm ± 1 cm) by using tread and fevicol glue. Each and every herbarium sheet was numbered and labeled. These were identified and categorized into different life forms and habits with the help of standard literatures and also at the herbarium of Department of Botany, Gauhati University.

RESULTS AND DISCUSSION

All total 228 plant species were identified under the 153 genera and 57 families [Table 1]. Out of which 71 moist soil species (Ms), 65 ecotone species (Eco), 57 rooted emergent hydrophytes (Reh), 12 free floating hydrophytes (Ffh), 10 rooted submerged hydrophytes (Rsh), 7 submerged floating hydrophytes (Sfh) and 6 rooted hydrophytes with floating leaves (Rhfl) were recorded in the present study sites. The life forms were recorded in the order of chamaephytes (68), hydrophytes (60), geophytes (28), hemicryptophytes (13) and phaenerophytes (2). The highest number of plant species was recorded in Bosasimalu wetland (136) followed by Borsola (120) and Borakota wetland (110), whereas the lowest number of plant species was recorded in Gereki (76) followed by Bhedelimora wetland (91). The highest number of chamaephytes was found in Borsola wetland (45) followed by Bhedelimora (36) and Borakota wetland (32). Likewise highest number of hydrophytes and helopytes in Bosasimalu wetland was found to be 56 and 16 respectively [Fig. 1]. Similarly, the highest number of hemicryptophytes was recorded as 6 each in Bosasimalu, Borsola, Bhedelimora and Gereki wetlands. The maximum number of moist soil species (44), rooted emergent(42), free-floating(11), rooted submerged(9), submerged floating(7) and rooted hydrophytes with floating leaves(5) was recorded in Bosasimalu wetland, whereas, the maximum number of ecotone species(36) was found in Borsola wetland [Fig. 2]. These results showed that the wetlands having less anthropogenic disturbances and good hydrological conditions are conducive for species composition. This may be explained in the case of Bosasimalu and Borsola wetlands. Alternation of hydrology has a considerable effect on the wetland ecosystems. Modification of rivers, reduction of flood plain areas and wetland drainage reduce the biodiversity and biotic integrity of many flood plain ecosystems [25]. The wetlands under the present study have also found to be possessed similar trend of threat as the feeder Rivers have been regulated by dykes, damages or blockage of outlet-inlet channels of the wetlands. This is quite noticeable in Borakota, Bhedelimora and Gereki wetlands.

Table 1: Floristic composition of five wetlands of Sonitpur district

[1= Bosasimalu, 2=Borsola, 3=Borakata, 4=Bhedelimora, 5=Gereki √= present, X=absent, chamae = chamaephytes, geo= geophytes, hydro= hydrophytes, helo= helophytes, hemi= hemicryptophytes, phanero= phanerophytes, Eco= ecotone species, Reh= rooted emergent hydrophytes, Ms= moist soil species, ffh=free floating hydrophytes, sfh=submerged floating hydrophytes, Rsh=rooted submerged hydrophytes, Rhfl=rooted hydrophytes with floating leaves, p= perennial A=annual].

Sl. Nos.	Name of the plant species	Name of the wetlands					Life forms	Families	Habit	Life span
		1	2	3	4	5				
1	*Acalypha indica* L	X	√	√	X	X	chamae	Euphorbiaceae	Eco	P
2	*Acrocephalus hispidus*(L.)Nicols.Et Siva	X	√	√	X	X	chamae	Lamiaceae	Reh	P
3	*Aeschnomene aspera* L.	√	X	√	X	X	chamae	Fabaceae	Reh	P
4	*A. indica* L	X	√	X	X	X	chamae	Fabaceae	Reh	P
5	*Ageratum conyzoides L.*	X	√	X	√	X	chamae	Asteraceae	Eco	P
6	*Alocasia cucullata* Schott.	√	√	√	√	√	geo	Araceae	Ms	P
7	*A. indica* Schott.	X	√	√	√	√	geo	Araceae	Ms	A
8	*Alternanthera philoxeroides* (Mart.) Griseb	√	√	√	√	√	hydro	Amaranthaceae	Reh	P
9	*A. sessilis*(L.) R.Br.ex R&S	√	√	X	X	X	hydro	Amaranthaceae	Reh	P
10	*Amaranthus spinosus* (L.)	X	√	X	√	√	chamae	Amaranthaceae	Eco	P
11	*A. viridis* L.	X	√	X	√	√	chamae	Amaranthaceae	Eco	P
12	*Amorphophallus companulatus* BL.	√	√	√	X	X	geo	Araceae	Ms	P
13	*Aponogeton crispus* Thumb.	√	√	√	X	X	hydro	Aponogetonaceae	Reh	P
14	*A. undulatus* Roxb.	√	X	√	X	X	hydro	Aponogetonaceae	Reh	P
15	*Apluda mutica* Linn.	√	X	X	X	X	geo	Poaceae	Ms	P
16	*A. varia* Hack.	√	X	X	X	X	geo	Poaceae	Ms	P
17	*Artimisia embrosides*	X	X	X	√	X	chamae	Asteraceae	Eco	P
18	*Arundinella bengalensis* (Spreng.) Druce.	√	X	√	X	X	geo	Poaceae	Eco	P
19	*Arundu donax* L.	√	X	√	X	X	geo	Poaceae	Ms	P
20	*Axonopus compressus* (Sw.)Beauv.	X	√	X	√	X	geo	Poaceae	Ms	P
21	*Azolla pinnata*	√	√	√	X	X	hydro	Azollaceae	Ffh	A
22	*Bergia capensis* L.	√	X	√	X	X	hydro	Elatinaceae	Ffh	P
23	*Borreria hispida* (L) K.Schum.	X	√	X	X	X	chamae	Rubiaceae	Eco	A
24	*Blyxa aubertti* Rick.	√	X	X	X	X	helo	Hydrocharitaceae	Rsh	A
25	*Capsella bursa-pastoris* Meic.	X	√	X	X	X	hemi	Brassicaceae	Eco	A
26	*Cardiospermum helicacabum* L.	X	X	X	√	X	chamae	Sapindaceae	Eco	P
27	*Carex cruciata* Wah.	X	X	√	X	X	helo	Cyperaceae	Eco	A
28	*C. muricata* L.	√	X	X	X	X	helo	Cyperaceae	Ms	A
29	*C. plebaja* Clarke.	X	X	√	X	X	helo	Cyperaceae	Reh	A
30	*Cassia occidentalis* L.	X	√	√	√	√	chamae	Fabaceae	Eco	P
31	*C. tora* L,	X	√	√	√	√	chamae	Fabaceae	Eco	P
32	*Cenchrus cillaris* L.	√	X	√	X	X	geo	Poaceae	Ms	P
33	*Centella asiatica* (L,) Urb	X	√	X	X	X	hemi	Araliaceae	Ms	A
34	*Ceratophyllum demersum* L.	√	√	√	X	√	hydro	Ceratophyllaceae	Sfh	P

35	*C. tuberculatum* Cham.	√	X	X	X	X	hydro	Ceratophyllaceae	Sfh	P
36	*Chenopodium album* L.	X	√	√	X	X	chamae	Amaranthaceae	Eco	P
37	*Chloris incompleta* L.	X	X	X	X	√	hemi	Poaceae	Ms	P
38	*Chromolaena odorata(*L)King& H.Erobins.	X	X	X	√	√	hemi	Asteraceae	Eco	P
39	*Chrysopogon aciculatus* Trin.	X	√	√	√	X	geo	Poaceae	Ms	P
40	*C. gryllus* Trin.	X	X	√	X	X	geo	Poaceae	Ms	P
41	*Cissampelosus pareira* L.	X	X	X	X	√	geo	Menispermaceae	Eco	P
42	*Cleome gynandra* (L.) L	X	√	X	X	X	chamae	Capparidaceae	Eco	A
43	*C. viscosa* L.	X	√	√	X	√	chamae	Capparidaceae	Eco	A
44	*Clerodendrum viscosum* vent.	X	√	√	√	√	chamae	Verbenaceae	Eco	P
45	*Coelorachis striata*(Nees ex. Steud) A	√	X	X	X	X	geo	Poaceae	Eco	P
46	*Colocasia esculanta* (L.) Schott.	√	√	√	√	√	helo	Araceae	Ms	P
47	*Commelina benghalensis* L.	√	√	√	√	√	hemi	Commelinaceae	Ms	P
48	*C. obliqua* Ham.	√	X	X	X	X	hemi	Commelinaceae	Ms	P
49	*C. paludosa* Blume.	√	X	X	X	X	hemi	Commelinaceae	Ms	P
50	*Cotula hemisphaerica* Wall ex Benth & Hook.f	√	X	X	X	X	hemi	Asteraceae	Ms	P
51	*Crotolaria juncea* L.	X	X	X	√	X	chamae	Fabaceae	Eco	P
52	*Cynodon dactylon* (L.) Pers.	X	√	√	√	√	geo	Poaceae	Eco	A
53	*Cyperus compactus* Retz.	X	√	X	X	X	helo	Cyperaceae	Reh	A
54	*C. compressus* L.	√	X	√	√	√	helo	Cyperaceae	Reh	A
55	*C. cyperoides* (L.) Kuntze.	√	X	√	√	X	helo	Cyperaceae	Reh	A
56	*C. digitatus* Roxb.	X	√	X	X	X	helo	Cyperaceae	Reh	A
57	*C. elatus* L.	√	X	√	X	X	helo	Cyperaceae	Reh	A
58	*C. haspan* L.	√	√	X	X	X	helo	Cyperaceae	Reh	A
59	*C. iria* L.	X	√	X	√	√	helo	Cyperaceae	Reh	A
60	*C. pilosus* Vahl.	√	√	X	X	X	helo	Cyperaceae	Reh	A
61	*C. rotundus* L.	√	√	√	√	√	helo	Cyperaceae	Reh	A
62	*Dactylis glomerata* L.	√	X	√	X	√	geo	Poaceae	Ms	P
63	*Desmodium trifolium* G. Don.	X	X	√	√	√	hemi	Fabaceae	Eco	P
64	*Desmostachya bipinnata* Stapf.	√	X	X	X	X	geo	Poaceae	Ms	P
65	*Digitaria longiflora (*Retz.) Pers.	√	√	√	√	X	geo	Poaceae	Ms	A
66	*D. marginata* Link.	X	√	X	X	X	geo	Poaceae	Ms	A
67	*D. sanguinalis* (L.)	√	X	X	√	X	geo	Poaceae	Ms	A
68	*Diplazium esculantum* (Retz.) Sw.	X	√	√	√	X	hemi	Athyriaceae	Ms	A
69	*Dopatrium junceum* Ham.	√	X	X	X	X	chamae	Scrophulariaceae	Eco	P
70	*Drymeria cordata*(L.) Willd. Ex R&S	X	√	√	√	X	hemi	Caryophyllaceae	Ms	A
71	*Eclipta prostrata* (L.)	X	√	X	X	X	chamae	Asteraceae	Eco	A
72	*Echinochloa compressus*	X	√	X	X	X	geo	Poaceae	Reh	P
73	*E. crus galli*(L.) P. Breauv.	√	X	X	X	X	geo	Poaceae	Reh	P
74	*E. stagnina* (Rets.) P. Beauv.	√	√	X	X	X	geo	Poaceae	Reh	P
75	*Eichhornia crassipes* Solms-Laub.	√	√	√	√	√	hydro	Pontederiaceae	Ffh	P
76	*Eleocharis atropurpurea* (Retz.) Presl. & Presl	√	X	X	X	X	helo	Cyperaceae	Reh	A
77	*E. dulcis* (Burm.f.)	√	√	X	X	X	helo	Cyperaceae	Reh	A
78	*Elephantopus scaber* Linn.	√	X	X	X	√	hemi	Asteraceae	Ms	A
79	*Elodea Canadensis* Rich. Mich.	√	X	X	X	√	hydro	Hydrocharitaceae	Rsh	P
80	*Eleusine indica* (L.) Gaertn.	X	√	X	√	√	geo	Poaceae	Ms	A
81	*Emilia sonchifolia* D.C.	X	√	√	X	X	chamae	Asteraceae	Eco	A
82	*Enhydra fluctuans* Laur.	√	√	√	√	√	hydro	Asteraceae	Ms	A
83	*Eragrostis atrovirens* (Desf.) Trin.	√	√	√	X	X	geo	Poaceae	Reh	A
84	*E. gangetica* (Roxb.)	√	X	X	X	X	geo	Poaceae	Reh	A
85	*E. tenella* (L) P. Beauv	X	√	X	X	X	geo	Poaceae	Reh	A
86	*E. uniloides* (Retz.)Nees ex steud.	√	X	√	√	√	geo	Poaceae	Reh	A
87	*Erianthus longisetosus* Andress.	X	√	√	X	X	geo	Poaceae	Eco	P
88	*Eriocaulon oryzaetorum* Mart.	√	√	X	X	X	geo	Eriocaulaceae	Reh	A
89	*E. trilobum* Ham.	√	X	X	X	√	geo	Eriocaulaceae	Reh	A
90	*E. viride* Koern.	√	X	X	X	X	geo	Eriocaulaceae	Reh	A
91	*Euphorbia hirta* L.	X	X	X	√	X	chamae	Euphorbiaceae	Ms	P
92	*Evolvulus numularis* (L.) L	X	√	X	X	X	chamae	Convolvulaceae	Ms	A
93	*Festuca rubra* L.	√	√	√	√	X	geo	Poaceae	Ms	A
94	*Fimbristylis aestivalis* (Retz.)	√	√	X	√	X	helo	Cyperaceae	Ms	A
95	*F. miliacea(*L) Vahl..	√	X	√	X	X	helo	Cyperaceae	Ms	P
96	*Fragaria indica* Andrews.	√	√	√	√	√	chamae	Rosaceae	Ms	A
97	*Gnaphallum indicum* Linn.	X	√	X	X	X	chamae	Asteraceae	Ms	P
98	*Grangia maderaspatana* (L.)	√	√	X	√	X	chamae	Asteraceae	Ms	P
99	*Hedyotis corymbosa (*L) Lamk.	X	√	√	√	√	chamae	Rubiaceae	Ms	P
100	*H. diffusa* Willd.	X	X	X	√	X	chamae	Rubiaceae	Ms	P
101	*Heliotropium indicum* L.	X	X	X	√	√	chamae	Boraginaceae	Eco	P

102	*Heteropogon contortus* (L.) Beauv.ex Roem& Schult	X	X	√	X	X	geo	Poaceae	Eco	P
103	*Hydrilla verticillata* (l.F.) Royle.	√	√	√	√	√	hydro	Hydrocharitaceae	Rsh	
104	*Hydrocharis cellulose* Buch-Ham.	√	X	X	X	X	hydro	Hydrocharitaceae	Reh	
105	*Hydrocotyle sibthorpioides* Thumb.	√	√	√	√	√	hemi	Araliaceae	Ms	P
106	*Hydrolea zeylanica* Vahl.	X	X	√	X	X	hydro	Hydroleaceae	Reh	P
107	*Hygrophila polysperma* (Roxb)T	√	X	X	X	√	hydro	Acanthaceae	Reh	P
108	*Hygroryza aristata* Nees.	√	√	√	√	√	hydro	Poaceae	Reh	P
109	*Hymenachne acutigluma* (Steud.)Gillil.	√	X	√	X	X	hydro	Poaceae	Reh	P
110	*H. assamica* Hitch.	√	√	√	√	√	hydro	Poaceae	Reh	P
111	*Ipomoea aquatica* Forsk.	√	X	√	√	√	hydro	Convolvulaceae	Reh	A
112	*I. carnea* Jacq.	√	√	√	√	√	chamae	Convolvulaceae	Ms	A
113	*Imperata cylindrica* (L) Beauv.	X	X	√	X	X	geo	Poaceae	Eco	A
114	*Ischaemum hirtum* Hack.	X	√	X	√	X	geo	Poaceae	Eco	A
115	*Isoetes coromandeliana*	X	√	X	X	X	hydro	Isoetaceae	Rsh	P
116	*Juncus articulatus* L.	√	X	√	X	X	geo	Juncaceae	Reh	A
117	*Jussieua repens* L.	√	X	√	X	√	hydro	Oenotheraceae	Ms	P
118	*J. suffruticosa* L.	√	X	X	X	X	hydro	Oenotheraceae	Ms	A
119	*Kyllinga brevifolia* Rottb.	X	X	√	X	√	helo	Cyperaceae	Ms	A
120	*Lantana camara* L.	X	√	X	X	√	chamae	Verbenaceae	Eco	P
121	*Leersia hexandra* Sw.	√	√	√	√	X	geo	Poaceae	Ms	A
122	*Lemna oligorrhiza* Kurz.	√	√	√	X	√	hydro	Lemnaceae	Ffh	A
123	*L. polyrrhiza* L.	√	X	X	X	X	hydro	Lemnaceae	Ffh	A
124	*Leucus aspera* L.	√	√	√	√	√	Chamae	Lamiaceae	Eco	P
125	*Leonurus sibiricus* Linn.	X	√	X	√	X	chamae	Lamiaceae	Eco	P
126	*Limnophila chinensis* Osbeck.	√	X	X	X	X	hydro	Scrophulariaceae	Reh	P
127	*Lippia javanica* (Burm.f) Spreng.	√	X	X	X	X	chamae	Verbenaceae	Eco	P
128	*L. gemiculata*	√	X	X	X	X	chamae	Verbenaceae	Eco	P
129	*Ludwigia adscendens* (L) Hara.	√	√	√	√	√	chamae	Onagraceae	Reh	P
130	*L. linearis* Walt.	X	X	√	√	√	chamae	Onagraceae	Reh	P
131	*L. octavalvis* Jacq.	X	X	√	X	X	chamae	Onagraceae	Reh	P
132	*L. parviflora* Roxb.	X	X	X	√	X	chamae	Onagraceae	Reh	P
133	*Marsilea quadrifolia* L.	√	X	√	√	√	hydro	Marsileaceae	Rhfl	A
134	*Mazus rugosa* Lour.	√	X	X	X	X	hydro	Scrophulariaceae	Ms	P
135	*Mikania mycrantha* Willd.	√	√	√	√	√	phanero	Asteraceae	Eco	A
136	*Mimosa invisa* Mart.ex Colla	X	X	X	√	X	chamae	Mimosae	Eco	A
137	*M. pudica* L.	X	√	√	√	√	chamae	Mimosae	Eco	A
138	*Monocharia hastata* (L) solms-Laub.	√	√	√	√	X	hydro	Pontederiaceae	Reh	P
139	*M. vaginalis*(Burn f.)Presl.	√	X	X	X	X	hydro	Pontederiaceae	Reh	P
140	*Myriophyllum tuberculatum* Roxb.	√	X	X	X	√	hydro	Haloragaceae	Rsh	P
141	*Najas indica* Cham.	√	X	X	X	X	hydro	Hydrocharitaceae	Sfh	P
142	*N. minor* All.	√	X	X	X	X	hydro	Hydrocharitaceae	Sfh	P
143	*Nasturtium officinale* R.Br.	√	X	X	X	X	chamae	Brassicaceae	Sfh	P
144	*Nelumbo nucifera* Gaerth.	X	X	X	√	X	hydro	Nelumbonaceae	Rhfl	P
145	*Neptunia prostrata* (Lamk)Ballion.	X	√	X	X	X	chamae	Fabaceae	Reh	P
146	*Nicotiana plumbaginifolia*	X	√	X	X	X	chamae	Solanaceae	Eco	A
147	*Nymphaea alba* L.	√	√	√	X	√	hydro	Nymphaeaceae	Rhfl	P
148	*N. nouchali* Burn.fsyn.	√	√	√	√	√	hydro	Nymphaeaceae	Rhfl	P
149	*N. stellata* Willd.	√	√	√	√	X	hydro	Nymphaeaceae	Rhfl	P
150	*Nymphoides cristata* (Roxb)O.Kuntze.	√	X	√	√	√	hydro	Menyanthaceae	Ffh	A
152	*N. hydrophyllum*	√	√	X	X	X	hydro	Menyanthaceae	Ffh	A
153	*N. indicum* (L) O. Kuntze.	√	X	√	X	X	hydro	Menyanthaceae	Ffh	A
154	*Oenanthe javanica* (BL.) DC.	√	√	X	X	X	hydro	Araliaceae	Ms	P
155	*O. suave var fasciculatum*	√	X	X	X	X	hydro	Araliaceae	Ms	P
156	*Ophiuros megaphyllus* Stapf.	X	X	√	X	X	geo	Poaceae	Eco	P
157	*Oryza officinalis* Wall.	√	√	√	X	√	geo	Poaceae	Reh	A
158	*O. rufipogon* Griff.	X	X	√	X	X	geo	Poaceae	Reh	A
159	*Ottelia alismoides* (L.) Pers.	√	√	X	X	√	hydro	Hydrocharitaceae	Rsh	P
160	*Ottochloa nodosa* Dandy	√	√	X	X	X	hydro	Poaceae	Reh	A
161	*Oxalis acetosella* L.	X	X	√	X	X	geo	Oxalidaceae	Ms	A
162	*O. corniculata* L.	X	√	X	X	X	geo	Oxalidaceae	Ms	A
163	*O. corymbosa* D.C.	X	√	√	√	√	geo	Oxalidaceae	Ms	A
164	*Paederia scandens* (Lour.) Merr.	X	X	X	√	X	phanero	Rubiaceae	Eco	P
165	*Panicum brevifolium* L.	X	√	X	X	√	helo	Poaceae	Ms	A
166	*P. maximum* Jacq.	√	√	√	√	√	helo	Poaceae	Ms	A
167	*P. paludosum* Roxb.	√	X	X	X	X	geo	Poaceae	Ms	A
168	*P. repens* L.	X	√	√	√	X	geo	Poaceae	Ms	A
169	*Paspalidium flovidium* A.Camus	√	X	X	√	X	geo	Poaceae	Eco	A

170	*Paspalum compactum* Roth.	X	X	X	√	√	geo	Poaceae	Eco	A
171	*P. orbiculare* G.Forst.	√	X	X	X	X	geo	Poaceae	Eco	A
172	*Phalaris aquatica* Ait.	√	X	X	X	X	geo	Poaceae	Reh	A
173	*Pheleum pretense* L.	√	X	X	X	X	geo	Poaceae	Reh	A
174	*Phyllanthus frateranus* Webster	X	√	√	X	X	chamae	Euphorbiaceae	Eco	A
175	*P. niruri*	X	√	X	X	X	chamae	Euphorbiaceae	Eco	A
176	*Pistia stratiotes* L.	√	√	√	√	√	hydro	Araceae	Ffh	A
177	*Poa annua* L.	√	X	√	X	X	geo	Poaceae	Ms	A
178	*Polycarpon tetraphyllum* L.	√	√	X	X	X	hydro	Caryophyllaceae	Ms	A
179	*Polygonum barbatum* L.	√	√	√	√	√	chamae	Polygonaceae	Eco	A
180	*P. glabrum* Willd.	√	√	√	√	√	chamae	Polygonaceae	Eco	A
181	*P. chinensis var. chinensis*	X	X	√	X	X	chamae	Polygonaceae	Ms	A
182	*P. hydro-piper* L.	√	√	√	√	√	chamae	Polygonaceae	Ms	A
183	*P. orientale* L.	X	√	X	X	X	chamae	Polygonaceae	Ms	A
184	*P. plebejum* R.Br.	√	√	X	√	X	chamae	Polygonaceae	Eco	A
185	*Pontederia cordata* L.	√	X	X	X	X	hydro	Pontederiaceae	Rsh	A
186	*Potamogeton natans* L.	√	X	√	X	X	hydro	Potamogetonaceae	Rsh	P
187	*P. indicus* Roxb.	√	X	X	X	X	hydro	Potamogetonaceae	Rsh	P
188	*P. nodusus*Poir.	√	X	X	X	X	hydro	Potamogetonaceae	Rsh	P
189	*Pouzolzia indica* Gaud.	X	√	X	X	X	chamae	Urticaceae	Eco	P
190	*Ranunculus aquatalis L.var.tricophylls*	√	√	X	X	X	hydro	Ranunculaceae	Reh	P
191	*R. scleretus* Linn.	√	√	X	X	X	hydro	Ranunculaceae	Reh	P
192	*Rauvolfia serpentine* (L.)	X	X	X	√	X	chamae	Apocynaceae	Eco	P
193	*Ricinus communis* L.	√	X	√	X	X	chamae	Euphorbiaceae	Eco	P
194	*Rumax maritimus* L.	√	√	√	X	√	chamae	Polygonaceae	Ms	A
195	*R. nepalansis* Spreng.	√	X	X	X	X	chamae	Polygonaceae	Ms	P
196	*Rungia parviflora* (L.) Nees.	X	√	√	√	X	chamae	Acanthaceae	Eco	A
197	*Saccharum spontaneum* L.	√	X	X	√	X	geo	Poaceae	Eco	A
198	*Sacciolepis indica* (L.) A.Shase.	√	√	X	X	X	geo	Poaceae	Eco	A
199	*Sagittaria guenensis*	X	√	X	X	X	hydro	Alismataceae	Reh	A
200	*S. latifolia* Willd.	√	√	√	X	X	hydro	Alismataceae	Reh	A
201	*S. sagitifolia* L.	√	√	√	√	√	hydro	Alismataceae	Reh	A
202	*Salvinia molesta* D.S.	√	√	√	√	√	hydro	Salviniacea	Ffh	A
203	*Scirpus articulatus* L.	√	X	√	√	√	helo	Cyperaceae	Reh	A
204	*S. debelis*	X	√	X	X	X	helo	Cyperaceae	Reh	P
205	*S. grossus* L.	√	X	X	√	X	helo	Cyperaceae	Reh	A
206	*Scoparia dulcis* L.	X	√	X	√	√	chamae	Scrophulariaceae	Eco	P
207	*Setaria glauca* (L.) Beauv.	√	X	X	√	X	geo	Poaceae	Ms	A
208	*Sida cordifolia* L.	X	√	√	X	√	chamae	Malvaceae	Eco	P
209	*Solanum nigrum* L.	√	√	√	√	√	chamae	Solanaceae	Eco	P
210	*S. torvum* Swartz.	√	√	√	√	√	chamae	Solanaceae	Eco	P
211	*Sphenoclea zeylanica* Gearth.	X	√	X	X	X	hydro	Campanulaceae	Ms	A
212	*Spilanthes acmella*	√	√	√	√	√	chamae	Asteraceae	Ms	P
213	*S. peniculata* Wall ex.	√	√	√	X	√	chamae	Asteraceae	Ms	P
214	*Spirodella polyrrhiza* (L.)Schl.	√	X	X	X	X	hydro	Lemnaceae	Ffh	P
215	*Sporobolus diander* Beauv.	√	X	X	X	X	geo	Poaceae	Ms	P
216	*Tabernaemontana divaricata* (L.) R.Br.ex	X	X	X	√	X	chamae	Apocynaceae	Eco	P
217	*Tephrosia vogelii* Hook. f	√	X	X	X	X	chamae	Fabaceae	Ms	P
218	*Trapa natans* L.	√	√	√	X	X	hydro	Trapaceae	Rhfl	A
219	*Triumfetta rhomboids* L.	X	X	√	X	X	chamae	Tiliaceae	Eco	P
220	*Typha angustata Bory&Chaub*	X	X	√	X	X	helo	Typhaceae	Ms	A
221	*T. elephantina* Roxb.	X	X	√	X	X	helo	Typhaceae	Ms	A
222	*Typhonium trilobatum* (L.) Schott.	X	X	X	√	X	helo	Araceae	Eco	A
223	*Utricularia aurea* Lour.	√	√	√	√	√	hydro	Lentibulariaceae	Sfh	A
224	*U. bifide* L.	√	X	√	X	X	hydro	Lentibulariaceae	Sfh	A
225	*Vetiveria zizanoides* (L). Nash.	X	X	√	√	X	geo	Poaceae	Eco	A
226	*Vicia alba* (Tourn.) L.	X	X	X	√	√	chamae	Fabaceae	Ms	A
227	*Wolfia arrhiza* Wimm.	√	√	√	√	√	hydro	Lemnaceae	Ffh	A
228	*Xanthium strumerium* L.	√	√	√	√	√	chamae	Asteraceae	Eco	A

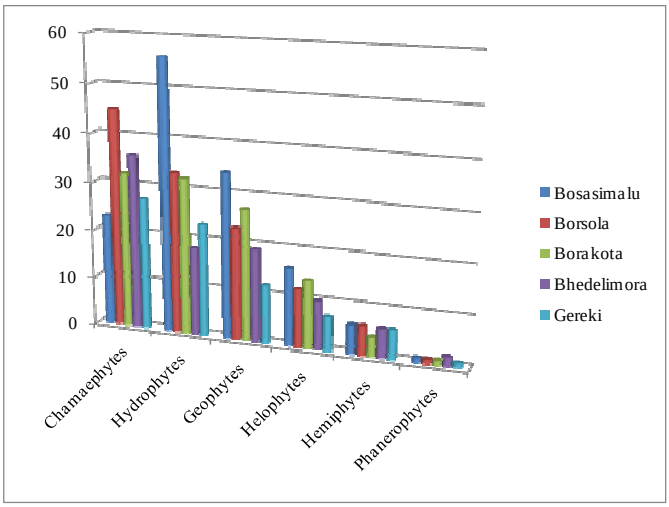

Figure 1: Bar diagram showing the composition of life forms of aquatic macrophytes of five wetlands of the Sonitpur district

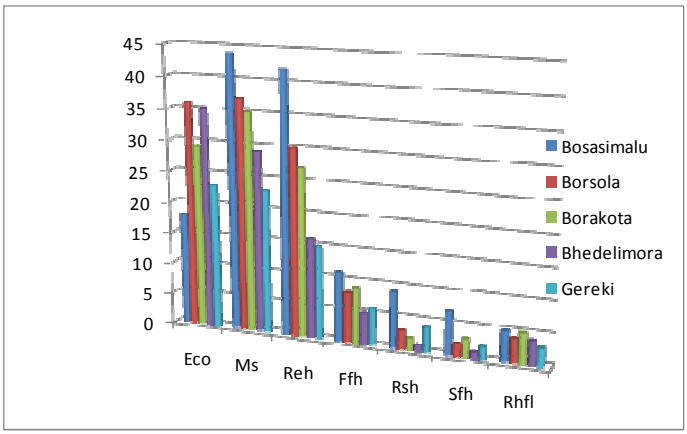

Figure 2: Bar diagram showing the composition of habits of aquatic macrophytes of five wetlands of the Sonitpur district

CONCLUSION

All together 228 plant species were identified under the 153 genera and 57 families during the present investigation from the five wetlands of Sonitpur district. During summer the large part of the wetlands are dominated by hydrophytes like *Ceratophyllum demersum*L, *Eichhornia crassipes* Solms-Laub, *Hydrilla verticillata* (I.F)Royle, *Hygroryza aristata* Nees., *Hymenachne assamica* Hitch, *Monocharia hastata* (L) Solms-Laub, *Nymphaea spp*, *Sagittaria sagitifolia* L, Trapa natans L, *Utricularia spp* etc. and other submerged, emergent, floating ,ecotone and moist soil plant species. The wet-dry period of the wetlands are also severely affected by prevention of river water flow by dykes, change in the river course, construction of roads on or near the wetlands and damage or blockage of inlet-outlet of the wetlands. Consequently extension of ecotone regions have also been observed during the summer seasons in some wetlands of the study site where plants like *Sagittaria sagitifolia* L, *Monocharia hastata*, (L) Solms-Laub species of Cyperus as well as wet grassland patches are found to be more frequent. Since the soils of wetlands are more or less remain hydric throughout the year, some moist soil plant species like *Axonopus compressus* (Sw.) Beauv., *Centella asiatica* (L) Urb., *Colocasia esculanta* (L)Schott., *Commelina benghalensis* L., *Diplazium esculantum* (Retz.), *Kyllinga brevifolia* Rottb., *Oxalis corymbosa* D.C, *Panicum maximum* Jacq., *Polygonum barbatum* L., *P. glabrum*Willd., *Spilanthes peniculata* Wall ex etc. were found to occur throughout the year.

The reduction of the depth of the wetlands of the district is of great concern. The depth of most of the wetlands of the present investigation is affected by the siltation. Siltation causes the waterbed to rise and, consequently, reduces the depth of the wetlands, which in turn result in the loss of perenniality, and subsequently of the wetland and its biodiversity.

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