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Diversity Indices of Aquatic Macrophytes in Jharokh Wetland, Assam, India

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The present study was conducted for a quantitative investigation of macrophytes of the Jharokh wetland of Hajo area of Kamrup district of Assam, during March 2015 to February 2016. During the investigation, 140 different species of macrophytes were recorded in pre-monsoon and 60 species in winter from the wetland. While the number of free-floating, rooted floating-leaved and submerged species are almost same in both the seasons of the wetland, the number of emergent species vary in both the two seasons i.e 80 in pre-monsoon and 38 in winter in the wetland respectively, based on Importance Value Index (IVI) Eicchornia crassipes (Mart.) Solms, Eurayle ferox Salisb, Ludwigia adscendes (L.) H. Hara, Hygroryza aristata (L.f.) Royle, Cyanodon dactylon and Hymenachne acutigluma (Steud) Gill, Leersia hexandra L. , Lemna minor, Ipomea carnea var.fistulosa were dominant species in pre monsoon whereas Eicchornia crassipes (Mart.) Solms , Ruppia maritima, Myrophullum alterniflorum, Chara vulgaris, Ceratophyllum demesrsum (L.), Nelumbo nucifera Gaertn, Nymphaea nouchalli Burm.f., Nymphoides indicum (L.) were dominant in winter.

Keywords: Wetlands, Important Value Index (IVI), Dominant Species, Diversity Indices, Aquatic macrophytes.

INTRODUCTION

Wetlands are important productive ecosystems of the world. They are potentially rich in aquatic resources, thereby maintaining the biodiversity on a large scale. They are the storehouse of different aquatic life forms and different flora, fauna, and avifauna. Wetlands not only supply bio-resources but also act as sources of livelihood for the people living in its vicinities. Wetlands are often described as "kidneys of the landscape" (1). These changes, in turn, have a direct impact on the biotic response on the wetlands (2). The most dominant and competitive aquatic macrophytic communities for sunlight in wetlands are free floating and rooted floating-leaved species when the nutrient concentration is sufficiently high.

Important Value Index (IVI) is a very important quantitative parameter. It is useful, as it provides an overall picture of the density, frequency, and cover of a genus in relation to the community (3). The maximum importance value for anyone genus is 300(100+100+100).The aquatic macrophyte communities reflect influence of anthropogenic effects and very useful to detect and asses human impacts.

Most of the parts of the wetland are degrading due to various anthropogenic activities like encroachment, excessive siltation due to flood, construction of roads, agricultural activities, and development of commercial fisheries, lack of inefficient inlets and outlets and growth of Eichhornia crassipes.

STUDY AREA

The study was conduct in Jharokh wetland of Hajo, Kamrup district of Assam which is situated at the global position 260 13/ 5// N to 260 18/ 5// N latitude and 910 30/ 41// E to 910 35/ 40// E longitude, covering an area of 162.74 ha. The wetland is covered by water along within aquatic vegetation almost throughout the year.

MATERIALS AND METHODS

The Jharokh wetland was surveyed during March 2015 to February 2016.During the study, 140 species of macrophytes from Jharokh wetland were collected and identified in the Department of Botany, Gauhati University.

To study the quantitative characteristics of the macrophyte communities of the Gorjaan wetland quadrates 1 m × 1 m were randomly placed to study the phytosociological characteristics of the species present within the macrophytic communities.20 quadrats were randomly placed in the wetland for pre-monsoon and also for the winter season in the study site. Importance Value Index (IVI) was calculated by summing the relative values of frequency, density, and abundance of the macrophytic species.

Four indices of species diversity like Shannon-Weiner Index, Simpson's Dominance Index, Simpson's Diversity Index, and Species Evenness Index were used to obtain various analytical data of the species by using the following formulas:

1. Shannon-Weiner Index of Diversity (H')

   $H' = - \Sigma p_i \log p_i$

   Where, pi= the proportion of importance value of the ith species (pi=ni/N, ni is the important value of ith species and N is the importance value of ith species.
2. Simpson's Index of Dominance (D) :

   $D = \Sigma (p_i)^2$

   Where, pi= the proportion of importance value of the ith species (pi=ni/N , ni is the important value of ith species and N is the importance value of ith species.

3. Simpson's Index of Diversity (D') :

   $D' = (1-D) = 1- \Sigma (p_i)^2$

   Where, pi= the proportion of importance value of the ith species (pi=ni/N , ni is the important value of ith species and N is the importance value of ith species.

4. Species Index Evenness (E) :

   $E = H'/ \log S$:

   Where, H' = Shannon-Weiner Index of Diversity, and log S= Natural log of the total number of species recorded.

RESULTS AND DISCUSSION

Altogether 140 species of macrophytes were recorded in the wetland, during the present investigation in pre-monsoon and winter season. Macrophytes were categorized into four major growth forms (8) as i.) Free-floating ii) Rooted floating-leaved iii) submerged and IV) emergent forms. In terms of a number of plant species, emergent plant species showed the largest number followed by submerged, then rooted floating-leaved and free-floating in the wetland both in pre-monsoon and winter season.

Among the free-floating macrophytes, the Important Value Index (IVI) of Eicchornia *crassipes* is the highest IVI value (IVI=65.60) in pre-monsoon and (IVI=98.18) in winter. Among the rooted floating-leaved *Hygroryza aristata* (IVI=27.07) highest in pre-monsoon and (IVI = 26.79) in winter. Among submerged *Hydrilla verticillata, Ceratophyllum submerrsum, Myrophyllum alterniflorum* were highest in pre monsoon *Hydrilla verticillata and Myrophyllum alterniflorm* were found over the year. *Ruppia maritima IVI=41.13, Myrophyllum alterniflorum (IVI=37.21), Chara vulgaris (IVI=36.96) Ceratophyllum demersum* (IVI= 29.37) was highest in winter.

Among the emergent species *Leersis hexandra, Hymeanche actigluma, Cynodon dactylon Typha elephntina, Ipomea aquatiaca, Enhydra fluctans* have highest IVI values and found dominant species in pre monsoon and throughout the year.

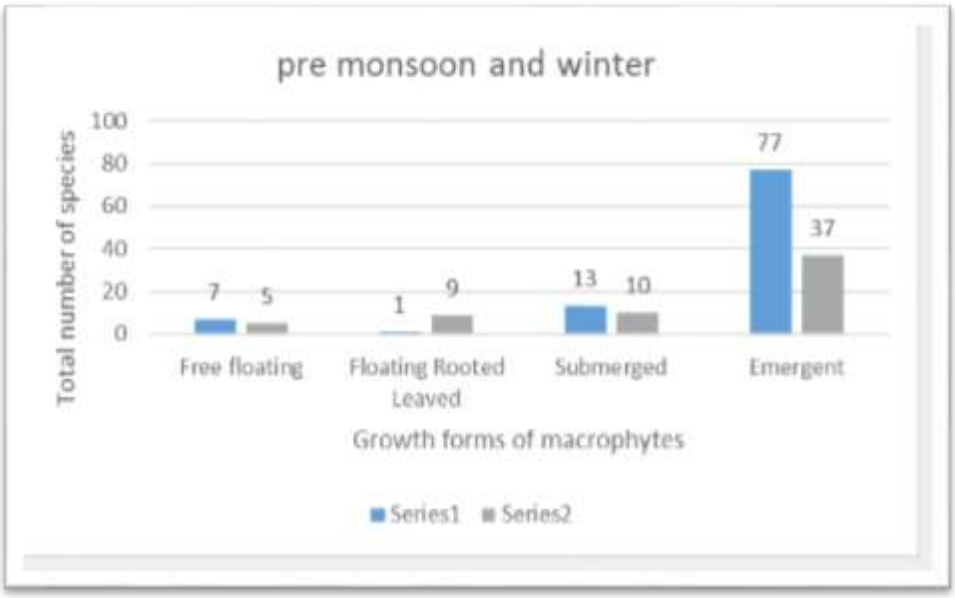

Figure 1. Number of Macrophyte species in pre-monsoon and winter

Table 1. Species Diversity of the Macrophytic community

	Pre-monsoon				Winter			
Growth of macrophytes	Shannon-Weiner Index, H'	Simpson's Dominance Index, D	Simpson's Diversity Index, D'	Evenness Index, E	Shannon-Weiner Index, H'	Simpson's Dominance Index, D	Simpson's Diversity Index, D'	Evenness Index, E
Free Floating	1.91	0.15	0.86	0.09	1.65	0.02	0.75	1.02
Roted Floating Leaved	2.37	0.06	0.95	0.09	2.14	0.03	0.96	0.97
Submerged	0.25	0.073	0.926	0.09	2.09	0.10	0.89	0.9
Emergent	4.3	0.01	0.98	0.99	0.36	0.02	0.97	0.09

Species diversity is a useful parameter for the comparison of communities and to know the ecological succession and stability of a community. The present study shows that the Shannon - Weiner index was highest in pre-monsoon in emergent i.e 4.3 and lowest in submerged i.e .25.Whereas in winter season the Shannon index was highest in rooted floating-leaved macrophytes. Shannon index is an index which is used in biological systems derived from a mathematical formula used in communication area by Shannon in 1948.In normal condition, Shannon index value remains between 0.0 -5.0.In some cases, the values vary between 1.5 -3.5 and also 4.5.The value above 3.0 indicates a stable community and value under 1.0 indicates a disturbed, imbalanced, unstable community. Simpson's index of dominance was highest i in pre-monsoon i.e 0.15 and lowest in winter .02.Simpson's diversity index was highest in pre-monsoon i.e .98 and lowest in winter i.e.75. Evenness index E was highest in winter 1.02 and lowest in summer .86

CONCLUSION

Based on the study, it can be concluded that Shannon diversity index shows that in both the seasons there is high species diversity. Based on Importance Value Index (IVI***)*** *Eicchornia crassipes (Mart.) Solms, Eurayle ferox Salisb, Ludwigia adscendes (L.) H. Hara, Hygroryza aristata (L.f.) Royle, Cyanodon dactyl on and Hymenachne acutigluma (Steud) Gill, Leersia hexandra L. Lemna minor, Ipomea carnea var.fistulosa were dominant species in pre-monsoon whereas Eicchornia crassipes (Mart.) Solms , Ruppia maritima, Myrophullum alterniflorum, Chara vulgaris, Ceratophyllum demesrsum (L.), Nelumbo nucifera Gaertn,* but such resourceful wetland is undergoing degradation process due to various anthropogenic as well as natural disturbances such as encroachment, habitat destruction, commercial fisheries, road development, excessive siltation, heavy flood, excessive growth of invasive species like *Eichhornia crassipes* , which are bio-indicators of pollution and disturbed wetland ecosystem etc.

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