

Comparative Study of Hydrophytes of Wetlands of Saran based on Importance Value Index

By

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Abstract:

Wetlands of Saran occupies 5.25% of total wetlands of Bihar as per National Wetlands Atlas and scattered around 21170 hectare. The wetland contains many species. Study was conducted to identify the phytosociological status of different waterlogged natural wetlands at 10 sites to identify the comparative importance value index of hydrophytes comprising of Non-anchored hydrophytes and anchored hydrophytes.

Keywords: Wetlands, Frequency, Density, Dominance, IVI

Introduction:

Wetlands are areas comprising of swamp, pond, peat, or water, natural or artificial, permanent or temporary, stagnant or flowing water. The wetlands are popularly known as earth's kidney because they provide same function as absorbing natural wastes. The abundance of various plants and animals makes it one of the major area in aquatic ecosystem. Saran District of State of Bihar has wetlands of 8.07% of total geographical area of 2624 square kilometer. The aquatic vegetation of the wetlands of saran in the post monsoon and pre monsoon are 1704 ha & 487 ha respectively as per national Atlas of Wetlands. Hydrophytes occupies a large part of total aquatic vegetation in the 2801 ha of waterlogged natural wetlands.

In community ecology quantitative values such as frequency, density, abundance and cover is of great importance although to have a real overall picture of ecological importance, IVI or Importance Value Index of the species is the more valid. Importance Value Index along with relative frequency, relative density and relative dominance gives the phytograph which shows the individual and combined aspects of the position of species in the community structure. To make the phytograph a circle is divided into four quadrants each for the relative frequency, relative density and relative dominance are put on the scale of 0 – 100 and Importance Value Index on a scale of 0-300.

Methodology:

10 different sites were visited in the natural water logged wetlands of saran and data was collected using quadrat sampling method of 1 square meter quadrat. The hydrophytes were counted to calculate frequency, density and dominance and on the basis of the data relative frequency, relative density and relative dominance was calculated. Importance Value Index was calculated using the data of relative frequency, relative density and relative dominance. The details of the calculation are as under.

$$\text{Relative Frequency} = \frac{\text{Total No of Occurrence of Species}}{\text{Sum total of Total No of Occurrence of Species}} \times 100$$

$$\text{Relative Density} = \frac{\text{Total No. of individuals of each species}}{\text{Sum total of Total No. of individuals of each species}} \times 100$$

$$\text{Relative Dominance} = \frac{\text{Total Basal area of species} \times \text{Average No. of Species in Quadrats}}{\text{Sum total of Total Basal area of species}} \times 100$$

$$\text{Importance Value Index} = \text{Relative Frequency} + \text{Relative Density} + \text{Relative Dominance}$$

The details of the calculation of 10 selected sites are as:

Site 1				
No. of Species	Relative Density	Relative Frequency	Relative Dominance	Importance Value Index
Non-anchored Hydrophytes				
Free floating Hydrophytes				
<i>Pistia stratiotes</i>	12.78	77.98	77.61	168.38
<i>Lemna gibba</i>	12.56	76.61	58.53	147.70
<i>Lemna trisulca</i>	13.31	81.19	35.69	130.19
<i>Spirodela polyrhiza</i>	12.03	73.39	82.09	167.51
<i>Spirodela punctata</i>	11.28	68.81	72.68	152.77
Submerged Hydrophytes				
<i>Najas minor</i>	1.65	10.09	62.36	74.11
Anchored Hydrophytes				
Floating Hydrophytes				
<i>Nymphaea nouchali</i>	1.65	10.09	87.09	98.83
<i>Euryale ferox</i>	1.58	9.63	80.40	91.61
Submerged Hydrophytes				
<i>Potamogeton nodosus</i>	1.95	11.93	91.04	104.93
<i>Blyxa echinosperma</i>	1.50	9.17	84.23	94.91
<i>Zannichellia palustris</i>	1.35	8.26	91.37	100.98
Emergent Hydrophytes				
<i>Aescynomene indica</i>	1.58	9.63	73.00	84.22
<i>Butomopsis latifolia</i>	1.65	10.09	62.69	74.43
<i>Eriocaulon setaceum</i>	1.95	11.93	64.18	78.06
<i>Monocharia vaginalis</i>	1.35	8.26	53.54	63.15

<i>Nepunia triquetra</i>	1.65	10.09	72.55	84.30
Marshy - Amphibious Hydrophytes				
<i>Ipomoea aquatic</i>	1.73	10.55	78.84	91.12
<i>Polygonum barbatum</i>	2.11	12.84	65.41	80.36
<i>Ludwigia octovalvis</i>	1.43	8.72	71.38	81.53
<i>Hygrophilla auriculata</i>	1.28	7.80	67.10	76.18
<i>Melochia corchorifolia</i>	1.65	10.09	51.78	63.53

Site 2	Relative Density	Relative Frequency	Relative Dominance	Importance Value Index
No. of Species				
Non-anchored Hydrophytes				
Free floating Hydrophytes				
<i>Pistia stratiotes</i>	12.07	77.98	77.97	168.02
<i>Lemna gibba</i>	12.23	76.61	53.46	142.29
<i>Wolffia arrhiza</i>	13.19	81.19	37.48	131.87
<i>Trapa natans</i> L. var. <i>bispinosa</i>	11.42	73.39	78.88	163.70
<i>Eichhorinia crassipes</i>	10.86	68.81	80.31	159.98
Submerged Hydrophytes				
<i>Potamogeton pectinatus</i>	1.85	10.09	62.65	74.59
Anchored Hydrophytes				
Floating Hydrophytes				
<i>Nelumbo nucifera</i>	1.85	10.09	87.48	99.43
<i>Aponogeton crispus</i>	1.77	9.63	80.77	92.17
Submerged Hydrophytes				
<i>Potamogeton nodosus</i>	1.93	11.93	88.46	102.32
<i>Blyxa echinosperma</i>	1.85	9.17	91.79	102.81
<i>Zannichellia palustris</i>	1.61	8.26	87.48	97.35
Emergent Hydrophytes				
<i>Sagittaria trifolia</i>	1.77	9.63	53.78	65.18

<i>Butomophis latifolia</i>	1.85	10.09	64.47	76.41
<i>Eriocaulon setaceum</i>	1.93	11.93	62.97	76.83
<i>Monocharia vaginalis</i>	1.61	8.26	70.08	79.94
<i>Monocharia hastate</i>	1.85	10.09	55.93	67.87
Marshy - Amphibious Hydrophytes				
<i>Polygonum glabrum</i>	2.01	10.55	79.20	91.77
<i>Polygonum hydropiper</i>	2.01	12.84	68.84	83.69
<i>Ludwiga octovalvis</i>	1.61	8.72	76.60	86.92
<i>Hygrophilla auriculata</i>	1.45	7.80	67.41	76.65
<i>Melochia corchorifolia</i>	1.77	10.09	52.02	63.88

Site 3	Relative Density	Relative Frequency	Relative Dominance	Importance Value Index
No. of Species				
Non-anchored Hydrophytes				0.00
Free floating Hydrophytes				0.00
<i>Pistia stratiotes</i>	9.39	69.67	74.38	153.44
<i>Lemna gibba</i>	9.23	68.44	56.09	133.76
<i>Lemna trisulca</i>	9.78	72.54	34.20	116.52
<i>Spirodela polyrhiza</i>	8.84	65.57	78.67	153.08
<i>Spirodela punctata</i>	8.29	61.48	76.62	146.38
<i>Wolffia arrhiza</i>	7.51	55.74	34.20	97.46
<i>Trapa natans L. var. bispinosa</i>	9.56	70.90	78.67	159.13
<i>Eichhorinia crassipes</i>	9.45	70.08	51.00	130.52
Submerged Hydrophytes				0.00
<i>Najas minor</i>	1.22	9.02	42.41	52.64
Anchored Hydrophytes				0.00
Floating Hydrophytes				0.00
<i>Nymphaea nouchali</i>	1.22	9.02	87.25	97.48
<i>Euryale ferox</i>	1.16	8.61	80.72	90.49
Submerged Hydrophytes				0.00
<i>Potamogeton nodosus</i>	1.44	10.66	87.25	99.34

<i>Blyxa echinosperma</i>	1.10	8.20	91.73	101.03
<i>Zannichellia palustris</i>	0.99	7.38	91.54	99.91
Emergent Hydrophytes				0.00
<i>Aescynomene indica</i>	1.16	8.61	69.96	79.73
<i>Butomopsis latifolia</i>	1.22	9.02	67.91	78.14
<i>Eriocaulon setaceum</i>	1.44	10.66	66.85	78.95
<i>Monocharia vaginalis</i>	0.99	7.38	55.41	63.78
<i>Nepenthes triquetra</i>	1.22	9.02	64.18	74.41
Marshy - Amphibious Hydrophytes				0.00
<i>Ipomoea aquatic</i>	1.27	9.43	61.57	72.26
<i>Polygonum barbatum</i>	1.55	11.48	54.85	67.87
<i>Ludwigia octovalvis</i>	1.05	7.79	57.46	66.30
<i>Hydrophyllum auriculata</i>	0.94	6.97	64.30	72.21
<i>Melochia corchorifolia</i>	1.22	9.02	49.63	59.86

Site 4				
No. of Species	Relative Density	Relative Frequency	Relative Dominance	Importance Value Index
Non-anchored Hydrophytes				
Free floating Hydrophytes				
<i>Pistia stratiotes</i>	12.78	77.27	77.61	167.67
<i>Lemna gibba</i>	12.56	75.91	58.53	147.00
<i>Lemna trisulca</i>	13.31	80.45	35.69	129.45
<i>Spirodela polyrhiza</i>	12.03	72.73	82.09	166.85
<i>Spirodela punctata</i>	11.28	68.18	72.68	152.14
Submerged Hydrophytes				
<i>Najas minor</i>	1.65	10.00	62.36	74.02
Anchored Hydrophytes				
Floating Hydrophytes				
<i>Nymphaea nouchali</i>	1.65	10.00	87.09	98.74
<i>Euryale ferox</i>	1.58	9.55	80.40	91.53
Submerged Hydrophytes				
<i>Potamogeton nodosus</i>	1.95	11.82	91.04	104.82
<i>Blyxa echinosperma</i>	1.50	9.09	84.23	94.83

<i>Zannichellia palustris</i>	1.35	8.18	91.37	100.90
Emergent Hydrophytes				
<i>Aescynomene indica</i>	1.58	9.55	73.00	84.13
<i>Butomopsis latifolia</i>	1.65	10.00	62.69	74.34
<i>Eriocaulon setaceum</i>	1.95	11.82	64.18	77.95
<i>Monocharia vaginalis</i>	1.35	8.18	53.54	63.07
<i>Nepunia triquetra</i>	1.65	10.00	72.55	84.20
Marshy - Amphibious Hydrophytes				
<i>Ipomoea aquatic</i>	1.73	10.45	78.84	91.03
<i>Polygonum barbatum</i>	2.11	12.73	65.41	80.24
<i>Ludwiga octovalvis</i>	1.43	8.64	71.38	81.45
<i>Hygrophilla auriculata</i>	1.28	7.73	67.10	76.10
<i>Melochia corchorifolia</i>	1.65	10.00	51.78	63.44

Site 5	Relative Density	Relative Frequency	Relative Dominance	Importance Value Index
No. of Species				
Non-anchored Hydrophytes				
Free floating Hydrophytes				
<i>Pistia stratiotes</i>	12.78	77.98	77.97	168.73
<i>Lemna gibba</i>	12.56	76.61	53.46	142.62
<i>Lemna trisulca</i>	13.31	81.19	37.48	131.98
<i>Spirodela polyrhiza</i>	12.03	73.39	78.88	164.30
<i>Spirodela punctata</i>	11.28	68.81	80.31	160.40
Submerged Hydrophytes				
<i>Najas minor</i>	1.65	10.09	62.65	74.39
Anchored Hydrophytes				
Floating Hydrophytes				
<i>Nymphaea nouchali</i>	1.65	10.09	87.48	99.23
<i>Euryale ferox</i>	1.58	9.63	80.77	91.98
Submerged Hydrophytes				

<i>Potamogeton nodosus</i>	1.95	11.93	88.46	102.34
<i>Blyxa echinosperma</i>	1.50	9.17	91.79	102.46
<i>Zannichellia palustris</i>	1.35	8.26	87.48	97.09
Emergent Hydrophytes				
<i>Aescynomene indica</i>	1.58	9.63	53.78	64.99
<i>Butomopsis latifolia</i>	1.65	10.09	64.47	76.22
<i>Eriocaulon setaceum</i>	1.95	11.93	62.97	76.85
<i>Monocharia vaginalis</i>	1.35	8.26	70.08	79.69
<i>Nepunia triquetra</i>	1.65	10.09	55.93	67.68
Marshy - Amphibious Hydrophytes				
<i>Ipomoea aquatic</i>	1.73	10.55	79.20	91.48
<i>Polygonum barbatum</i>	2.11	12.84	68.84	83.79
<i>Ludwigia octovalvis</i>	1.43	8.72	76.60	86.74
<i>Hygrophilla auriculata</i>	1.28	7.80	67.41	76.48
<i>Melochia corchorifolia</i>	1.65	10.09	52.02	63.77

Site 6	Relative Density	Relative Frequency	Relative Dominance	Importance Value Index
No. of Species				
Non-anchored Hydrophytes				
Free floating Hydrophytes				
<i>Pistia stratiotes</i>	12.78	77.98	77.61	168.38
<i>Lemna gibba</i>	12.56	76.61	58.53	147.70
<i>Lemna trisulca</i>	13.31	81.19	35.69	130.19
<i>Spirodela polyrhiza</i>	12.03	73.39	82.09	167.51
<i>Spirodela punctata</i>	11.28	68.81	72.68	152.77
Submerged Hydrophytes				
<i>Najas minor</i>	1.65	10.09	62.36	74.11
Anchored Hydrophytes				

Floating Hydrophytes				
<i>Nymphaea nouchali</i>	1.65	10.09	87.09	98.83
<i>Euryale ferox</i>	1.58	9.63	80.40	91.61
Submerged Hydrophytes				
<i>Potamogeton nodosus</i>	1.95	11.93	91.04	104.93
<i>Blyxa echinosperma</i>	1.50	9.17	84.23	94.91
<i>Zannichellia palustris</i>	1.35	8.26	91.37	100.98
Emergent Hydrophytes				
<i>Aescynomene indica</i>	1.58	9.63	73.00	84.22
<i>Butomopsis latifolia</i>	1.65	10.09	62.69	74.43
<i>Eriocaulon setaceum</i>	1.95	11.93	64.18	78.06
<i>Monocharia vaginalis</i>	1.35	8.26	53.54	63.15
<i>Nepunia triquetra</i>	1.65	10.09	72.55	84.30
Marshy - Amphibious Hydrophytes				
<i>Ipomoea aquatic</i>	1.73	10.55	78.84	91.12
<i>Polygonum barbatum</i>	2.11	12.84	65.41	80.36
<i>Ludwiga octovalvis</i>	1.43	8.72	71.38	81.53
<i>Hygrophilla auriculata</i>	1.28	7.80	67.10	76.18
<i>Melochia corchorifolia</i>	1.65	10.09	51.78	63.53

Site 7				
No. of Species	Relative Density	Relative Frequency	Relative Dominance	Importance Value Index
Non-anchored Hydrophytes				
Free floating Hydrophytes				
<i>Pistia stratiotes</i>	12.78	77.98	77.97	168.73
<i>Lemna gibba</i>	12.56	76.61	53.46	142.62
<i>Lemna trisulca</i>	13.31	81.19	37.48	131.98
<i>Spirodela polyrhiza</i>	12.03	73.39	78.88	164.30
<i>Spirodela punctata</i>	11.28	68.81	80.31	160.40
Submerged Hydrophytes				

<i>Najas minor</i>	1.65	10.09	62.65	74.39
Anchored Hydrophytes				
Floating Hydrophytes				
<i>Nymphaea nouchali</i>	1.65	10.09	87.48	99.23
<i>Euryale ferox</i>	1.58	9.63	80.77	91.98
Submerged Hydrophytes				
<i>Potamogeton nodosus</i>	1.95	11.93	88.46	102.34
<i>Blyxa echinosperma</i>	1.50	9.17	91.79	102.46
<i>Zannichellia palustris</i>	1.35	8.26	87.48	97.09
Emergent Hydrophytes				
<i>Sagittaria trifolia</i>	1.58	9.63	53.78	64.99
<i>Butomopsis latifolia</i>	1.65	22.00	64.47	88.13
<i>Eriocaulon setaceum</i>	1.95	26.00	62.97	90.93
<i>Monocharia vaginalis</i>	1.35	18.00	70.08	89.43
<i>Monocharia hastate</i>	1.65	22.00	55.93	79.59
Marshy - Amphibious Hydrophytes				
<i>Ipomoea aquatic</i>	1.73	23.00	79.20	103.93
<i>Polygonum barbatum</i>	2.11	28.00	68.84	98.94
<i>Ludwiga octovalvis</i>	1.43	19.00	76.60	97.03
<i>Hygrophilla auriculata</i>	1.28	17.00	67.41	85.68
<i>Melochia corchorifolia</i>	1.65	22.00	52.02	75.67

Site 8				
No. of Species	Relative Density	Relative Frequency	Relative Dominance	Importance Value Index
Grassland plants near the wetlands				
<i>Saccharum procerum</i>	3.23	19.20	34.62	57.04
<i>Saccharum bengalens</i>	2.93	17.41	41.72	62.06
<i>Arundinell bengalensis</i>	2.93	17.41	44.33	64.67
<i>Phragmites karka</i>	2.86	16.96	32.66	52.48

Non-anchored Hydrophytes				
Free floating Hydrophytes				
<i>Pistia stratiotes</i>	12.78	75.89	77.97	166.64
<i>Lemna gibba</i>	12.56	74.55	53.46	140.56
<i>Lemna trisulca</i>	13.31	79.02	37.48	129.81
<i>Spirodela polyrhiza</i>	12.03	71.43	78.88	162.34
<i>Spirodela punctata</i>	11.28	66.96	80.31	158.56
Submerged Hydrophytes				
<i>Najas minor</i>	1.65	9.82	62.65	74.12
Anchored Hydrophytes				
Floating Hydrophytes				
<i>Nymphaea nouchali</i>	1.65	9.82	87.48	98.96
<i>Euryale ferox</i>	1.58	9.38	80.77	91.72
Submerged Hydrophytes				
<i>Potamogeton nodosus</i>	1.95	11.61	88.46	102.02
<i>Blyxa echinosperma</i>	1.50	8.93	91.79	102.22
<i>Zannichellia palustris</i>	1.35	8.04	87.48	96.87
Emergent Hydrophytes				
<i>Aescynomene indica</i>	1.58	9.38	53.78	64.73
<i>Butomopsis latifolia</i>	1.65	9.82	64.47	75.95
<i>Eriocaulon setaceum</i>	1.95	11.61	62.97	76.53
<i>Monocharia vaginalis</i>	1.35	8.04	70.08	79.47
<i>Nepunia triquetra</i>	1.65	9.82	55.93	67.41
Marshy - Amphibious Hydrophytes				
<i>Ipomoea aquatic</i>	1.73	10.27	79.20	91.20
<i>Polygonum barbatum</i>	2.11	12.50	68.84	83.44
<i>Ludwigia octovalvis</i>	1.43	8.48	76.60	86.51
<i>Hygrophilla auriculata</i>	1.28	7.59	67.41	76.27
<i>Melochia corchorifolia</i>	1.65	9.82	52.02	63.50

Site 9	Relative Density	Relative Frequency	Relative Dominance	Importance Value Index
No. of Species				

Non-anchored Hydrophytes				
Free floating Hydrophytes				
<i>Pistia stratiotes</i>	12.78	77.98	77.97	168.73
<i>Lemna gibba</i>	12.56	76.61	53.46	142.62
<i>Lemna trisulca</i>	13.31	81.19	37.48	131.98
<i>Spirodela polyrhiza</i>	12.03	73.39	78.88	164.30
<i>Spirodela punctata</i>	11.28	68.81	80.31	160.40
Submerged Hydrophytes				
<i>Najas minor</i>	1.65	10.09	62.65	74.39
Anchored Hydrophytes				
Floating Hydrophytes				
<i>Nymphaea nouchali</i>	1.65	10.09	87.48	99.23
<i>Euryale ferox</i>	1.58	9.63	80.77	91.98
Submerged Hydrophytes				
<i>Potamogeton nodosus</i>	1.95	11.93	88.46	102.34
<i>Blyxa echinosperma</i>	1.50	9.17	91.79	102.46
<i>Zannichellia palustris</i>	1.35	8.26	87.48	97.09
Emergent Hydrophytes				
<i>Aescynomene indica</i>	1.58	9.63	53.78	64.99
<i>Butomopsis latifolia</i>	1.65	10.09	64.47	76.22
<i>Eriocaulon setaceum</i>	1.95	11.93	62.97	76.85
<i>Monocharia vaginalis</i>	1.35	8.26	70.08	79.69
<i>Nepunia triquetra</i>	1.65	10.09	55.93	67.68
Marshy - Amphibious Hydrophytes				
<i>Ipomoea aquatic</i>	1.73	10.55	79.20	91.48
<i>Polygonum barbatum</i>	2.11	12.84	68.84	83.79
<i>Ludwigia octovalvis</i>	1.43	8.72	76.60	86.74
<i>Hygrophilla auriculata</i>	1.28	7.80	67.41	76.48
<i>Melochia corchorifolia</i>	1.65	10.09	52.02	63.77

Site 10				
No. of Species	Relative Density	Relative Frequency	Relative Dominance	Importance Value Index
Non-anchored Hydrophytes				
Free floating Hydrophytes				
<i>Pistia stratiotes</i>	12.78	77.98	78.79	169.55
<i>Lemna gibba</i>	12.56	76.61	59.42	148.58
<i>Lemna trisulca</i>	13.31	81.19	36.23	130.73
<i>Spirodela polyrhiza</i>	12.03	73.39	83.33	168.76
<i>Spirodela punctata</i>	11.28	68.81	81.16	161.24
Submerged Hydrophytes				
<i>Najas minor</i>	1.65	10.09	46.97	58.72
Anchored Hydrophytes				
Floating Hydrophytes				
<i>Nymphaea nouchali</i>	1.65	10.09	44.93	56.67
<i>Euryale ferox</i>	1.58	9.63	27.67	38.88
Submerged Hydrophytes				
<i>Potamogeton nodosus</i>	1.95	11.93	92.42	106.31
<i>Blyxa echinosperma</i>	1.50	9.17	85.51	96.19
<i>Zannichellia palustris</i>	1.35	8.26	88.41	98.02
Emergent Hydrophytes				
<i>Aescynomene indica</i>	1.58	9.63	97.17	108.38
<i>Butomopsis latifolia</i>	1.65	10.09	96.97	108.72
<i>Eriocaulon setaceum</i>	1.95	11.93	92.42	106.31
<i>Monocharia vaginalis</i>	1.35	8.26	74.11	83.72
<i>Nepunia triquetra</i>	1.65	10.09	71.94	83.68
Marshy - Amphibious Hydrophytes				
<i>Ipomoea aquatic</i>	1.73	10.55	58.70	70.98
<i>Polygonum barbatum</i>	2.11	12.84	67.98	82.93
<i>Ludwigia octovalvis</i>	1.43	8.72	70.82	80.96

<i>Hygrophilla auriculata</i>	1.28	7.80	65.22	74.29
<i>Melochia corchorifolia</i>	1.65	10.09	58.10	69.85

Results and Discussion

In almost all the sites Free Floating Hydrophytes *Pistia stratiotes*, *Lemna gibba*, *Lemna trisulca*, *Spirodela polyrhiza*, *Spirodela punctate* and Submerged Hydrophytes *Potamogeton nodosus* and Emergent Hydrophytes *Aescynomene indica*, *Butomopsis latifolia*, *Eriocaulon setaceum* shows high Importance Value Index compared to other hydrophytes. The high Importance Value Index of Free Floating Hydrophytes, and some other hydrophytes contribute to oxygen production, and the nutrient uptake and transfer to higher trophic levels. The emergent hydrophytes shade out surfaces preventing algal growth and may eliminate oxygen exchange – thus enhancing reduction reactions. Submerged Hydrophytes *Potamogeton nodosus* helps the oxidation and precipitation of heavy metals on root surfaces. The combination of all the hydrophytes contribute organic matter which supports the microbial communities which participate in various nutrient transformations, especially denitrification and sulfur reduction.

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