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Biodiversity and Phytosociological Analysis of Plants around the embarkment area of Daha River in Siwan

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Abstract

The paper deals with the ecological studies of embarkment of River Daha in Siwan in relation to biodiversity and phytosociological analysis of plants at three sites. The area where the study was carried out is productive in reference to the nutrient quality however, reiver is periodically gets much polluted due to discharge of sugar factories wastes and distilley effluents as reflected by low dissolved oxygen, high BOD and COD values and low pH. Species were identified with different stages of growth in the three selected sites (I, II, III). The number of species at three different sites were grouped seasonally in summer, rainy and winter. Phytosociological characters namely frequency, density and abundance were influenced by the climatic, anthropogenic and biotic stresses in the sites. All the species present at the study sites have shown maximum values of frequency, density and abundance in rainy season in comparison to that of summer and winter seasons.

Keywords : Phytosociology, Biodiversity, Daha River, Abundance, Density, Frequency

Introduction

Walter G. Rosen coined the term biodiversity – the short form of biological diversity in 1985. Phytosociology coined by Paczoski is the study of aspects of communal relations of plant. This study is vital for understanding the functioning of community. The study of plant community implies data of structure and composition of the species. Stone and Frayer (1935) discovered the combined influence of plant height, basal area, density and range of species on 'complexity index' within the analysis of vegetation face. The vegetation fluctuates from season to season and year to year.

The River Daha is a small perennial stream of about 96 km length. A 13 sq km marshy Chaur, the Sasamusa-Chaur, north of Siwan town about 28.8 km upstream, acts as a balancing reservoir ensuring a small perennial supply of water all through the year. Daha river joins the Ghaghra river 48 km below Siwan to Chapra town.

Methodology

Three sites selected is marked in the maps in the images. Each site was demarcated for one hectare area, half hectare on both the sides of the Daha River. While studying the phytosociology each tiller was considered as one plant and plants that were creeping each 5 cm composing of plants having roots were considered as an individual plant. The current The study was done for three seasons Summer, Rainy and Winter seasons. for understanding the seasonal variation. The density was calculated using 50 x 50 cm quadrat. Different parameters for each species were calculated with the help of specific formulae listed

$$\text{Frequency} = \frac{\text{No. of quadrats in which species occurred}}{} \times 100$$

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$$\text{Density} = \frac{\text{Total no. of individuals of a species in all quadrats}}{\text{Total no. of quadrats sampled}}$$

$$\text{Abundance} = \frac{\text{Total no. of individuals of a species in all quadrats}}{\text{Total no. of quadrats in which species occurred}}$$

Basal Cover = *Average basal area* X *Density*

Where,

Average basal area = πr^2 (cm^2). where r is radius of stem at emerging point.
Radius = Average diameter (cm)/2

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Observations & Calculations

Changes in Frequency (%) of Plant Species At Sites I, II and III (Based on 50 Quadrat Sampling)

Sl. No	Plant Species	Summer			Rainy			Winter		
		I	II	III	I	II	III	I	II	III
1	*Achyranthes aspera*	10	8	4	24	22	20	28	24	18
2	*Alternanthera paronychioides*	8	-	6	18	12	16	-	4	8
3	*Alternanthera sessilis*	6	8	-	22	30	18	20	24	16
4	*Amaranthus Spinosus*	18	12	6	26	20	22	16	18	14
5	*Amiscophacelus axillaris*	-	4	6	16	20	14	10	12	14
6	*Anchusa tenella*	4	-	4	8	10	-	-	12	8
7	*Anisomeles indica*	-	-	-	20	12	16	22	16	12
8	*Arundo donax*	-	4	-	14	18	12	8	10	6
9	*Bacopa monnieri*	4	-	-	10	8	6	4	6	4
10	*Bothriospermum tenellum*	6	-	4	12	14	8	6	8	10
11	*Caesulia axillaris*	-	-	-	4	6	-	12	14	-
12	*Calotropis procera*	-	4	4	8	10	6	6	4	-
13	*Cleome viscose*	-	-	-	6	4	6	4	-	-
14	*Croton bonplandianum*	8	12	-	16	18	14	20	16	-
15	*Cynodon dactylon*	50	48	34	80	92	88	100	96	98
16	*Cyperus difformis*	-	-	-	20	16	8	-	10	6
17	*Dentella repens*	-	4	6	6	8	-	8	4	6
18	*Desmostachya bipinnata*	12	10	14	20	24	18	16	-	10
19	*Eclipta prostrate*	10	8	10	16	10	20	4	8	6
20	*Euphorbia hirta*	12	14	16	20	12	18	8	10	12

Changes in Abundance (M^2) of Plant Species At Sites I, II And III (Based on 50 Quadrat Sampling)

Sl. No	Plant Species	Summer			Rainy			Winter		
		I	II	III	I	II	III	I	II	III
1	*Achyranthes aspera*	4.8	2.75	4.5	24	13	8.3	4.21	4.75	3.56
2	*Alternanthera paronychioides*	2.5	-	4	13	5.5	4.38	-	4.5	3.5
3	*Alternanthera sessilis*	4	3.25	-	9.73	5.74	4.67	5.2	3.34	3.38
4	*Amaranthus Spinosus*	2.78	4.67	4.34	8.85	13.3	4.45	5.5	4.67	4.86
5	*Amiscophacelus axillaris*	-	2.5	1.67	19	10.4	7.29	5.2	2.83	2.14
6	*Anchusa tenella*	3.5	-	3.5	4.5	3.8	-	-	2.67	2.25
7	*Anisomeles indica*	-	-	-	7	5.17	4.75	4.36	3.13	4.67
8	*Arundo donax*	-	2.5	-	2.29	9.56	3.34	3.75	2.2	1.67

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9	*Bacopa monnieri*	3.5	-	-	2.8	6.5	7	2	4	4.5
10	*Bothriospermum tenellum*	3.67	-	1.5	5.34	3.29	7.25	5.66	4.5	3.8
11	*Caesulia axillaris*	-	-	-	5.5	6.34	-	4.67	4.57	-
12	*Calotropis procera*	-	2.5	3	2.75	2.6	1.67	4.34	3	-
13	*Cleome viscose*	-	-	-	4.34	3	3.34	2.5	-	-
14	*Croton bonplandianum*	2.25	2.17	-	4.88	4.12	2.71	4.7	4	-
15	*Cynodon dactylon*	49.8	65.63	107.4	112	135	94.72	91.04	74	100.5
16	*Cyperus difformis*	-	-	-	9.8	3.88	6.5	-	4.4	4.34
17	*Dentella repens*	-	1.5	2.67	4.67	4.25	-	2.75	4.5	3.34
18	*Desmostachya bipinnata*	3	3.2	3	6.3	4.42	5.23	4.13	-	4.6
19	*Eclipta prostrate*	3.4	2.25	3	4.75	4.4	4.8	2	4.75	2.67
20	*Euphorbia hirta*	3.66	3.86	3	8.8	7.17	8.12	4.25	4.2	3

Changes in Basal Cover (Cm^2M^2) Of Plant Species at Sites I, II and III (Based On 50 Quadrat Sampling)

Sl. No	Plant Species	Summer			Rainy			Winter		
		I	II	III	I	II	III	I	II	III
1	*Achyranthes aspera*	0.05	0.02	0.02	0.62	0.31	0.18	0.13	0.12	0.07
2	*Alternanthera paronychioides*	0.0003	-	0.004	0.04	0.01	0.01	-	0.003	0.005
3	*Alternanthera sessilis*	0.003	0.004	-	0.03	0.03	0.01	0.02	0.01	0.008
4	*Amaranthus Spinosus*	0.04	0.02	0.02	0.16	0.19	0.07	0.06	0.04	0.05
5	*Amiscophacelus axillaris*	-	0.003	0.003	0.2	0.07	0.03	0.02	0.01	0.009
6	*Anchusa tenella*	0.008	-	0.008	0.02	0.02	-	-	0.02	0.01
7	*Anisomeles indica*	-	-	-	0.01	0.005	0.006	0.008	0.004	0.004
8	*Arundo donax*	-	0.1	-	0.32	1.74	0.4	0.3	0.22	0.1
9	*Bacopa monnieri*	0.05	-	-	0.11	0.2	0.16	0.03	0.09	0.07
10	*Bothriospermum tenellum*	0.16	-	0.04	0.47	0.34	0.42	0.25	0.26	0.28

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11	*Caesulia axillaris*	-	-	-	0.03	0.05	-	0.08	0.09	-
12	*Calotropis procera*	-	0.02	0.02	0.04	0.04	0.02	0.04	0.02	-
13	*Cleome viscose*	-	-	-	0.02	0.009	0.02	0.008	-	-
14	*Croton bonplandianum*	0.009	0.01	-	0.04	0.04	0.02	0.05	0.03	-
15	*Cynodon dactylon*	1.94	2.46	2.85	6.99	9.69	6.9	7.1	5.54	7.68
16	*Cyperus difformis*	-	-	-	0.26	0.08	0.07	-	0.06	0.03
17	*Dentella repens*	-	0.009	0.03	0.04	0.05	-	0.03	0.03	0.03
18	*Desmostachya bipinnata*	0.02	0.02	0.03	0.08	0.06	0.06	0.04	-	0.03
19	*Eclipta prostrate*	0.04	0.02	0.04	0.2	0.06	0.12	0.01	0.05	0.02
20	*Euphorbia hirta*	0.01	0.02	0.02	0.06	0.03	0.05	0.01	0.01	0.01
Total		2.33	2.7	3.08	9.74	13.02	8.44	8.18	6.6	8.4

Results & Discussion

Frequency reveals the degree of dispersion of individual species in an area and is expressed in terms of percentage occurrence. From the density values it is clear that total peak density values 115.68, 142.7 and 100.28 m^2 for all species were recorded during rainy season and their respective minimum density values were 28.14, 33.92 and 38.98 m^2, recorded during summer season in the respective three sites I, II and III. On the perusal of Change in abundance it is clear that abundance values of *Cynodon dactylon* were recorded maximum throughout the whole study period. During summer the values were 49.80, 65.63 and 107.41 m^2, during rainy season the values were recorded 112.00, 135.00 and 94.72m^2 and during the season of winter the abundance values of *C. daclyton* were recorded 91.04, 74.00 and 100.51m^2 at the site I, II and III, respectively. The values of basal cover for all the plant species were maximum during rainy season, i.e., 9.74, 13.02 and 8.44 cm^2m^2 at sites I, II and III, respectively.

Plant sociological characters such as frequency, density and abundance were exclusively influenced by the natural as well as biotic stresses prevailing at the present study sites. Maximum values of frequency and density were recorded in rainy season and minimum in summer season. Plants have shown comparatively higher frequency and density, consequently higher degree on dispersion and numerical strength of species in winter season on account of most sustainable climatic conditions. It seems, in such natural communities, that stability appears to depend on the balance between the stability and variability of the environment.

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