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PHYTOSOCIOLOGICAL STUDY OF HERBS AND GRASSES IN WINTER SEASON ON THE BOTTOMS OF RAVINE OF OTTANGAN RIVER AT KHANDER, AGRA, U.P.

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Phytosociological study of herbs and grasses in winter season on the bottoms of protected and unprotected ravines of Ottangan river has been done by standard methods in two years. During the course of study, it has been observed that frequency, density, abundance, presence and sociability increased in protected ravine in comparison to unprotected ravine. *Euphorbia hirta* Linn., *Cynodon dactylon* (L.) Pers. and *Abutilon indicum* (Linn.) Sweet. were more abundant and more successful species inspite of biotic interference in unprotected ravine. *Cynodon dactylon* was in more reduced form in unprotected ravine in comparison to other species due to grazing factor.

Keywords: Biotic factor, Grazing, Khander, Ottangan river, protected ravine, Phytosociology, unprotected ravine.

Introduction

In India, out of a total geographical area of approx. 330 million hectares, almost fifty percent land area has been affected by soil erosion and degradation in humid and sub-humid climate. However, strong wind, high evaporation rate and high temperature accelerate the process of desertification in semi-arid and arid regions. The ravines are formed in alluvial soil along the banks of rivers because of erosiveness of rain water coupled with the effect of flash floods. In India ravine land area is estimated approximately 36.7 lakh hectares. Out of this, 12.3 lakh hectares of ravines are located in Uttar Pradesh, about 33 % of the total ravine land in the country. In Uttar Pradesh, Agra district accounts for 1.76 lakh hectares of ravine land mainly located along the river Yamuna. On the conservation measures, the country is losing a total output of Rs.157 crores a year by failure to reclaim and develop the ravines. The ravines in India are not of recent origin; they date back to the eleventh century and are still growing. An intensive system of gullies forms ravines. These ravines, caused by the major rivers and their tributaries, are extending fast towards agricultural lands and habitats[1]. The phytoremedial technology is useful to slowdown the increasing critical ravenous condition of land. The phytosociological study of herbs and grasses is essential, showing actual structure of plants of lower strata.

According to the overall density and species richness in the herbaceous layer expands with decline in protection due to increase in the occurrence of unpalatable and obnoxious species[2]. In a study, it has been observed that studied that phytosociology is a useful characteristic to describe the population dynamics of each plant species occurring in a particular community and to explain how they deals to other species in a same community[3]. The impact of protection on the plant cover was significantly higher on protected sites as compared to unprotected sites[4]. The grazing pressure was the main cause of decreasing number of annual species from 87% on the protected land to 57 % on the unprotected land area. Biotic

interferences were studied on effect on three topographies of vegetation (top, slope and bottom) of two sites, protected and unprotected subtropical Yamuna ravines in Agra[5].

Material and Methods:

Experimental Site–The Khander experimental site is comprised of ravine system made up of different classes of gullies varying from very shallow to very deep. This village is spread over 553 sq. hectare land area situated in deep ravine on the sides of Ottangan River. This river has very high current and large area of spread. The residents of this village do not build permanent residences due to the high current of the river which destroys their houses. This Ottangan river is formed by combination of various streams and this village is near the combination side.

Climatic condition of experimental site – The experimental site has dry climate except during the rainy season, with an average annual rainfall of 765 mm; 90 % annual rainfall is received during the rainy season. Monsoon rain which starts in the last week of June and very active in July to August, tapering off by the middle of September, causes considerable erosion, May – June being the hottest months when the maximum temperature touches 48°C and minimum temperature goes as low as 1°C in month of December – January. The evaporation ratio is also high due to strong wind velocity and high temperature.

The phytosociological studies were done on the bottom in the protected and unprotected ravine by quadrate method[6,7] and impact of protection on the herbs and grasses has been recorded. Quadrate of 50 sq cm was laid down at 10 random spots for herbs and grasses on the selected sites in winter season and following characters were noted.

A. Analytical characters:

1. Quantitative characters – For herbs and grasses the following quantitative values were observed in each plant community:

a. Frequency – The number of quadrates in which a given species occurred and thus expresses the distribution for dispersion of various species in a community.

$$\frac{No.\ of\ quadrats\ in\ which\ species\ occurred}{Total\ no.of\ quadrats\ studied} \times 100$$

b. Density – The number of individuals per sampling unit in a community (species may or may not occur in all sampling units) as-

$$\frac{\text{Total no. of individuals of the species in all sampling units}}{\text{Total number of sampling units studied}} \times 100$$

c. Abundance – Number of individuals of a species per sampling units of occurrence as-

$$\frac{\text{Total number of individual of species in all sampling units}}{\text{Total number of sampling units in which species occurred}}$$

2. Qualitative characters–

Sociability – It represents to the space relationship among plants or how closely together the individual plants grow[8]. Thus, the degree of sociability that a species will develop in an area, depends upon the biological equipment of species in relation to environment. Braun – Blanquet scale[9] given below for determining sociability of species was used.

S1 = Grow one in a place, singly
S2 = Groups or tufts
S3 = In troops, small patches or cushions
S4 = In small colonies, in extensive patches or making carpets
S5 = In great gathering (pure populations)

B. Synthetic characters –

Presence and Constance – It shows the extent of occurrence of individuals of a particular species in the community. Constance expresses the interrelation between different communities up to some extent. Values of presence and constance were calculated from the frequency data in following five figures[10]:

Presence and constance 1 = 1% to 20% frequency
Presence and constance 2 = 21% to 40% frequency
Presence and constance 3 = 41% to 60 % frequency
Presence and constance 4 = 61 % to 80 % frequency
Presence and constance 5 = 81 % to 100 % frequency

Results and Discussion

Origin and expansion of ravines in India dates back to 11th century. The ravines are still forming and growing into wider areas. The rivers and their tributaries play major role in the formation of these ravines. They are extending fast towards agricultural lands and habitats[1]. The present investigation reveals that on the bottom of protected ravine, *Sida cordata* Linn., *Justicia simplex* D. Don., *Cenchrus ciliaris* Linn., *Heteropogon contortus* (L.) Roem and Schult. and *Desmostachya bipinata* (L.) Stapf. were found most abundant herbs and grasses in winter season of first year study. *Justicia simplex*, *Cenchrus ciliaris* and *Heteropogon contortus* were found most abundant species of lower strata on bottom in winter season of second year study. Depending upon the overall density and species richness, the herbaceous layer expands with decline in protection due to increase in the occurrence of unpalatable and obnoxious species[2].

Table 1 – Quantitative, qualitative and synthetic values of herbs and grasses on bottom of protected and unprotected ravines in winter season of first year study.Particular of Quadrats – 10 (50 cm.^{2}).

S. No	Name of species	Bottom of protected ravine					Bottom of unprotected ravine				
		F	D	A	P	S	F	D	A	P	S
1	*Abutilon indicum* (Linn.) Sweet.	70	0.7	1.0	4	1	50	0.7	1.4	3	1
2	*Achyranthus aspera* Linn.	20	0.2	1.0	1	1	30	0.8	2.6	2	1
3	*Argemon mexicana* Linn.	30	0.3	1.0	2	1	20	0.3	1.5	1	1
4	*Blepharis molluginifolia* Pers.	-	-	-	-	-	30	1.3	4.3	2	1
5	*Boerhaavia diffusa* Linn.	40	0.8	2.0	2	1	60	1.8	3.0	3	2
6	*Cenchrus ciliaris* Linn.	50	3.5	7.0	3	1	40	0.7	1.7	2	1
7	*Commelina benghalensis* Linn.	40	1.2	3.0	2	2	-	-	-	-	-
8	*Convolvulus arvensis* Linn.	60	1.6	2.6	3	3	-	-	-	-	-
9	*Convolvulus microphyllus* (Roth.) Sieb ex spring	70	1.7	2.4	3	4	60	0.6	1.0	3	1
10	*Coronopus didymus* (Linn.) SM.	40	0.7	1.7	2	2	-	-	-	-	-
11	*Cymbopogon jwarancusa* (Jones.) Schult.	60	2.8	4.6	3	2	50	0.5	1.0	3	2
12	*Cynodon dactylon* (Liinn.) Pers.	60	2.1	3.5	3	4	80	4.0	5.0	4	4
13	*Desmostachya bipinnata* (L.) Stapf.	60	3.6	6.0	3	3	50	1.0	2.0	3	2
14	*Echinops echinatum*Roxb.	10	0.2	0.2	1	1	-	-	-	-	-
15	*Eclipta alba* (L.) Hassk.	10	0.1	1.0	1	1	-	-	-	-	-
16	*Euphorbia hirta* Linn.	40	0.8	2.0	2	1	80	4.0	5.0	4	4
17	*Heteropogon contortus* (L.) Roem&Schult.	50	3.5	7.0	3	3	-	-	-	-	-
18	*Hibiscus micranthus* Linn.	70	1.7	2.4	4	2	-	-	-	-	-
19	*Justicia simplex* D. Don.	40	2.4	6.0	2	2	50	1.4	2.8	3	1
20	*Launaea procumbens* (Roxb.) Rammaya&Rajgopal	20	1.4	2.0	1	1	-	-	-	-	-
21	*Lindenbergia indica* (L.) Vatke.	30	1.2	4.0	2	1	30	0.3	1.0	2	1
22	*Pavonia zeylanica* (Linn.) Cav.	40	1.2	3.0	2	1	30	1.2	4.0	2	1
23	*Peristrophe bicalyculata* (Retz.) Nees.	80	2.1	2.6	4	1	30	1.3	4.3	2	1
24	*Rungia pectinate* (Linn.) Nees.	30	0.4	1.3	2	1	-	-	-	-	-
25	*Saccharum munja* Roxb.	10	0.2	2.0	1	3	20	0.2	1.0	1	3
26	*Saccharum spontaneum* Linn.	40	1.4	3.5	2	1	-	-	-	-	-
27	*Sida cordata* Burm. F.	90	4.5	5.0	5	3	-	-	-	-	-
28	*Sida cordifolia* Linn.	100	3.8	3.8	5	4	-	-	-	-	-
29	*Solanum nigrum* Linn.	30	0.7	2.4	2	1	20	0.2	1.0	1	1
30	*Sonchus brachyotes* Dc.	30	0.9	3.0	2	1	-	-	-	-	-
31	*Spergula arvensis* Linn.	30	0.4	1.3	2	1	-	-	-	-	-
32	*Stellaria media* (Linn.) Vill.	50	0.5	1.0	3	2	-	-	-	-	-
33	*Tephrosia purpurea* Linn.	40	1.2	3.0	2	1	40	0.4	1.0	2	1
34	*Tragus roxburghii* Panigrahi.	50	1.2	2.4	3	2	-	-	-	-	-
35	*Tridex procumbens* Linn.	40	0.5	1.2	2	2	50	0.5	1.0	3	2

F = Frequency, **D** = Density, **A** = Abundance, **P** = Presence and constance, **S** = Sociability, **-** = Species absent.

Table no. 2 – Quantitative, qualitative and synthetic values of herbs and grasses on the bottom of protected and unprotected ravines in winter season of second year study. Particular of quadrats – 10 (50 cm.^{2}).

S.No.	Name of species.	Bottom of protected ravine.					Bottom of unprotected ravine.				
		F	D	A	P	S	F	D	A	P	S
1	*Abutilon indicum* (Linn.) Sweet.	80	1.9	2.3	4	1	100	5.0	5.0	5	4
2	*Achyranthus aspera* Linn.	100	3.5	3.5	5	4	40	0.7	1.7	2	1
3	*Argemon Mexicana* Linn.	40	0.4	1.0	2	1	30	0.3	1.0	2	1
4	*Blepharis malluginifolia* Pers.	40	1.4	3.5	2	1	30	0.3	1.0	2	1
5	*Boerhaavia diffusa* Linn.	40	0.4	1.0	2	1	70	1.7	2.4	4	2
6	*Cenchrus ciliaris* Linn.	40	2.4	6.0	2	1	90	0.9	1.0	5	2
7	*Commelina benghalensis* Linn.	30	0.3	1.0	2	1	-	-	-	-	-
8	*Convolvulus arvensis* Linn.	70	1.7	2.4	4	3	60	0.7	1.1	3	1
9	*Convolvulus microphyllus* (Roth) Sieb. ex Spreng.	60	1.6	2.6	3	2	-	-	-	-	-
10	*Coronopus didymus* (Linn.) Sm.	40	0.4	1.0	2	2	-	-	-	-	-
11	*Cymbopogon jwarancusa* (Jones) Schult.	10	0.4	4.0	1	1	40	0.4	1.0	2	1
12	*Cynodon dactylon* (linn.) Pers.	100	3.4	3.4	5	4	90	4.5	5.0	5	4
13	*Desmostachyabipinnata* (L.) Stapf.	60	1.4	2.3	3	2	50	1.2	2.4	3	3
14	*Echinops echinatum*Roxb.	10	0.2	2.0	1	1	-	-	-	-	-
15	*Ecliptaalva* (L.) Hassk.	10	0.2	2.0	1	1	-	-	-	-	-
16	*Euphorbia hirta* Linn.	70	0.9	1.2	4	1	60	1.2	2.0	3	2
17	*Heteropogon contortus* (L.) Roem and Schult.	30	1.8	6.0	2	1	-	-	-	-	-
18	*Hibiscus micranthus* Linn.	60	1.2	2.0	3	2	-	-	-	-	-
19	*Justicia simplex* D. Don.	40	2.0	5.0	2	1	60	0.3	1.0	2	1
20	*Launaea procumbens* (Roxb.) Rammaya and Rajgopal	30	1.4	4.6	2	1	-	-	-	-	-
21	*Lindenbergia indica* (L.) Vatke	30	1.2	4.0	2	1	40	0.4	1.0	2	1
22	*Pavonia zeylanica* (Linn.) Cav.	30	1.2	4.0	2	1	40	1.3	3.2	2	1
23	*Peristrophe bicalyculata* (Retz.) Nees.	50	0.5	1.0	3	1	30	1.3	4.3	2	1
24	*Rungia pectineta* Linn.	30	0.4	1.3	2	1	-	-	-	-	-
25	*Saccharum munja*Roxb.	10	0.2	2.0	1	2	30	0.4	1.3	2	3
26	*Saccharum spontaneum* Linn.	30	1.4	4.6	2	1	-	-	-	-	-
27	*Sida cordata*Burm. F.	50	0.9	1.8	3	1	-	-	-	-	-
28	*Sida cordifolia* Linn.	30	1.2	4.0	2	2	-	-	-	-	-
29	*Solanum nigrum* Linn.	40	0.7	1.7	2	1	20	0.4	2.0	1	1
30	*Sonchus brachyotes* Dc.	40	0.9	2.2	2	1	-	-	-	-	-
31	*Spergula arvensis* Linn.	20	0.2	1.0	2	1	-	-	-	-	-
32	*Stellaria media* (Linn.) Vill.	60	0.7	1.1	3	2	-	-	-	-	-
33	*Tephrosia purpurea* Linn.	20	0.2	1.0	1	1	40	0.4	1.2	2	1
34	*Tragus roxburghii*Panigrahi	40	1.2	3.0	2	1	-	-	-	-	-
35	*Tridex procumbens* Linn.	30	0.3	3.0	2	1	60	0.6	1.0	3	2

F = Frequency, **D** = Density, **A** = Abundance, **P** = Presence and constance, **S** = Sociability, **-** = Species absent.

In unprotected ravine, *Euphorbia hirta* and *Cynodon dactylon* were found abundantly on bottom in winter season of first year of study. *Abutilon indicum* and *Cynodon dactylon* were found on bottom most abundant herbs and grasses in winter season of second year study.

During the course of study, it was observed that frequency, density, abundance, presence and constance and sociability of almost all species increased except a few species on the bottom in winter season of protected ravine in comparison to unprotected ravine. The species of unprotected ravine were destroyed by over exploitation due to severe grazing by domestic animals and human interference etc. resulting in barren land. Similar effects were earlier observed in various studies[2,5].

In winter season, the observations recorded on bottom of protected ravine showed that the sociability classes 4 & 5 were poorly present due to the occurrence of colonial habit. It was also observed by the distribution of species that 1, 2, and 3 sociability classes were highly present. The unprotected ravine generally occupied by 1 and 2 sociability classes.

Presence shows the extent of occurrence of individuals of a particular species in the community while. constance expresses the

interrelation between different communities up to some extent[10]. Presence and constance classes showed that the frequency distribution of the species was 4 and 5 of some species in winter season on bottom of protected ravine whereas 1, 2 and 3 presence and constance classes were generally present in winter season on bottom of protected ravine but in unprotected ravine during both year of study, it was recorded that presence and constance classes 4 and 5 were rarely present whereas 1, 2 and 3 presence constance classes were commonly present on bottom in winter season.

Conclusion

It has been concluded after two year's study on the bottom of protected and unprotected ravines in winter season, that herbs and grasses were highly affected by protection and approximately 50% species of herbs and grasses destroyed by over exploitation due to severe over grazing by domestic animals and human interference in unprotected ravine.

Euphorbia hirta, Cynodon dactylon, *Abutilon indicum* were more successful species inspite of biotic interference in unprotected ravine. *Cynodon dactylon* was in more reduced form in unprotected ravine in comparison to other species due to grazing factor.

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