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Seasonal species distribution and dominance in grazed Terai grassland of Budhanagar, Nepal

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Abstract

Assessment of seasonal distribution and dominancy of herbaceous species of a grazed grassland of Budhanagar, eastern Terai region of Nepal was carried out in 2010. A total of 33 species: grasses (10), sedges (5), legumes (4) and non- legumes (14) were recorded with distinct seasonal occurrence. Most dominant species throughout the year were: *Chrysopogon aciculatus* (biomass 91.0-1720.5 g/m^2; IVI 78.8-99.8); *Desmodium triflorum* (biomass 30-679.3 g/m^2; IVI 13.8-41.7) and *Imperata cylindrical* (biomass 12.0-83.3 g/m^2; IVI 20.7-34.6). Maximum total community biomass (3650.7 ± 19.1 g/m^2) was recorded in rainy and minimum (175.0 ± 4.1 g/m^2) in summer season. Maximum percent contribution by biomass and IVI of grasses was in winter season (90.3 and 76.2); sedges (17.1 and 19.0) and legume (12.6 and 15.0) in rainy season and that of non-legume in summer season (7.5 and 15.7) to the total community biomass and IVI, respectively.

Key words: Biomass, density, forbs, grasses, IVI, legumes.

Introduction

Grasslands are important in terms of biodiversity and sources of forage for domestic livestock. In the Terai plain of Nepal grasslands occur along flood plains and terraces. Cultivation and massive grazing has changed the species composition of palatable and native species. Heavy grazing has caused retrogression from bunchgrass dominant swards to prostrate, low-producing, grazing tolerant but nutrient-poor, allelochemic-rich grasses and forbs (Jha & Jha, 2000; 2002; Jha, 2003).The grassland communities are being invaded by unpalatable species to cattle. On the other hand grasslands are continually being lost to agriculture, human settlements and urbanization. In this context, assessment of grassland quality is inevitable. This study is aimed to understand the seasonal distribution and dominancy of species in grazed grassland of Terai.

The study area (2.5 ha) is located in Budhnagar-5, Vediyari (Lat. 26° 22' N, Long 87° 16' E, Alt 72 msl) in eastern Terai plain of Nepal. The climate is tropical and monsoon. There are three distinct seasons in a year *viz*. rainy (July-October), winter (November-February) and summer (March-June). Soil is alluvial and loamy in texture (sand 40%, silt 40% and clay 20%. The average pH of the soil (0-10 cm depth) is 6.5. Average meteorological data indicate 1225, 5, and 188 mm rainfall; 25,10.4 and 19.6°C minimum air temperature; 32.2, 25 and 33.6°C maximum air temperature; and 6, 3.8 and 6, 3.8 and 7.3 km/h wind speed during rainy, winter and summer season, respectively for the last five years. The study area is fallow land subjected to heavy grazing by cows and buffaloes of different ages throughout the season.

Materials and Methods

Ten quadrats of size 30 cm × 30 cm were sampled in the grazed field during winter (January), summer (May) and rainy (September) seasons. Collected samples (live shoots and rhizomes) were washed and brought to the laboratory and after proper sorting and processing oven dried to a constant weight at 80°C

Table 1. Seasonal occurrence of species in the study site (+ present, - absent).

S.N.	Plant species	Family	Summer	Rainy	Winter
	Monocotyledonae - Grasses				
1.	*Axonopus compressus* (Swartz.) Beauv.	Poaceae	+	+	+
2.	*Brachiaria villosa*(Lam.)	Poaceae	-	-	+
3.	*Chrysopogon aciculatus*(Retz.)Trin.	Poaceae	+	+	+
4.	*Cynodon dactylon*(L.) Pers	Poaceae	+	+	+
5.	*Dicanthium annulatum* (Forsk.) Stapf.	Poaceae	+	+	+
6.	*Hemarthria compressa* (L. f) R. Br	Poaceae	+	+	-
7.	*Imperata cylindrica* (L.) Beauvois	Poaceae	+	+	+
8.	*Paspalum distichum* L.	Poaceae	+	+	+
9.	*Saccharum spontaneum* L.	Poaceae	+	+	+
10.	*Settaria palludefusca* (Scmach. Sapf & C.E. Hubbard	Poaceae	-	+	+
	Monocotyledonae - Sedges				
11.	*Cyperus rotundus* L.	Cyperaceae	-	+	+
12.	*Eriocaulon viridae* Korn.	Cyperaceae	-	+	+
13.	*Fimbristylis miliacea* (L.) Vahl.	Cyperaceae	-	+	-
14.	*Kyllinga brevifolia* Rottb.	Cyperaceae	+	+	+
15.	*Murdania nudiflora* (L.) Brenan	Cyperaceae			
	Dicotyledonae - Legumes				
16.	*Alysicarpus vaginalis* (L.) DC.	Fabaceae	-	+	+
17.	*Desmodium triflorum* (L.) DC.	Fabaceae	+	+	+
18.	*Indigofera linifolia* (L. f) Retz.	Fabaceae	-	+	-
19.	*Mimosa pudica* (L.) Mukurjee	Fabaceae	+	+	
	Dicotyledonae - Non legumes				
20.	*Ageratum conyzoides* L.	Asteraceae	-	-	+
21.	*Centella asiatica* (L.) Urb.	Apiaceae	-	+	+
22.	*Euphorbia hirta* L.	Euphorbiaceae	+	+	+
23.	*Evolvulus nummularius* L.	Convolvulaceae	+	+	+
24.	*Hedyotis corymbosa* (L.) Lam.	Rubiaceae	-	+	-
25.	*Hemigraphis hirta* (Vahl.) T. Anders	Acanthaceae	-	+	+
26.	*Hygrophila polysperma* (Roxb.)T.And	Acanthaceae	-	+	-
27.	*Ixeris polycephala* Cass.	Asteraceae	-	+	-
28.	*Lindernia oppositifolia* (L.) Mukurjee	Scrophulariaceae	-	+	-
29.	*Parthenium hysterophorus* L.	Asteraceae	+	+	+
30.	*Phyllanthus amarus* Schumacher	Euphorbiaceae	+	+	+
31.	*Rungia parviflora* (Retz.) Nees	Acanthaceae	+	-	+
32.	*Solanum nigrum* L.	Solanaceae	+	+	+
33.	*Veronia cinerea* (L.) Lees	Asteraceae	+	-	-

Dominance was determined by phytosociological assessment of the samples (Zobel *et al.*, 1987). Plant species were identified by standard literature (Siwakoti & Varma, 1999). The identified species were cross checked with the specimens housed at the Tribhuvan University Regional Herbarium (TURH), Department of Botany, Post Graduate Campus, T.U., Biratnagar, Nepal.

Table 2. Seasonal range of frequency (%), density (ind./m^2), biomass (g/m^2) and IVI of major species (IVI >13) in the grazed grassland.

species	Frequency (%)	Density(Ind./m^2)	Biomass (g/m^2)	IVI
Chrysopogon aciculatus	90-100	375.5-7749.2	91.0-1720.5	78.8-99.8
Desmodium triflorum	80-100	30.0-679.3	30-679.3	13.8-41.7
Imperata cylindrica	90-100	187.8-336.3	12.0-83.3	20.7-34.6
Dicanthium annulatum	30-90	42.2-128.8	7.0-188.7	11.5-34.7
Paspalum distichum	90-100	97.6-208.7	15.0-299.7	21.6-30.0
Evolvulus nummularius	60-70	45.5-114.4	10.5-27.8	7.6-23.6
Fimbristylis miliacea	0-100	0-218.7	0-344.1	0-24.0
Setaria paludefusca	20-90	6.7-305.2	6.7-305.2	3.3-19.9
Rungia pectinata	0-90	0-68.9	2.2-21.6	15.7-19.0
Hemarthria compressa	0-100	0-160	0-18.0	0-33.0
Cynodon dactylon	0-70	0-42.2	1.6-66.7	8.4-15.2
Axonopus compressus	10	22.2-53.3	6.4-88.8	4.0-13.2

Table 3. Seasonal variation in biomass (g/m^2) and IVI of different plant groups (figure in parenthesis represent percent value; ± mean standard error).

Grassland community	Biomass (g/m^2)			IVI		
	Winter	**Summer**	**Rainy**	**Winter**	**Summer**	**Rainy**
Grasses	157.6±3.9 (90.1)	2511.5±15.8 (68.8)	1718.4±13.1 (90.3)	227.5±4.7 (75.9)	164.7±4.0 (54.9)	228.5±4.7 (76.2)
Sedges	3.3±0.5 (1.8)	623.3±7.8 (17.1)	33.3±1.8 (1.8)	11.5±1.0 (3.8)	56.6±2.3 (19.0)	9.0±0.9 (3.1)
Legumes	1.0±0.3 (0.6)	460.6±6.7 (12.6)	111.3±3.3 (5.8)	13.8±1.1 (4.6)	45.4±2.1 (15)	34.8±1.8 (11.6)
Non legumes	13.1±1.1 (7.5)	55.3±2.3 (1.5)	39.9±1.9 (2.1)	47.2±2.1 (15.7)	33.3±1.8 (11.1)	39.2±1.9 (13.1)
Total	**175.0±4.1**	**3650.7±19.1**	**1902.9±13.7**	**300±5.4**	**300±5.4**	**300±5.4**

Results and Discussion

The grazed grassland had a total of 33 species/ genera and 12 families. Number of species recorded in the site was: grasses (10), sedges (5), legumes (4) and non legumes (14) with distinct seasonal distribution (Table 1). Jha and Jha (2000) recorded the presence of 31 species out of which 20 were graminoids, 2 legume and 9 non legume forbs in the grazed grassland of Terai plain. Number of species in rainy, winter and summer season was 24, 22 and 17, respectively. Sorrensen's similarity index (SI) of grassland species in rainy and winter season was maximum (66.7%) while that with summer season was minimum (48.6%) in the study site. Dominant species were: *Chrysopogon aciculatus* (biomass range 91.0-1720.5 g/m^2 and IVI range 78.8-99.8), *Imperata cylindrica (*biomass range 12.0-83.3 g/m^2 and IVI range 20.7-34.6) *Dicanthium annulatum (*biomass range 7.0-188.7 g/m^2 and IVI range 11.5-34.7) among grasses; *Desmodium triflorum* (biomass range 30-679.3 g/m^2 and IVI *range* 13.8-41.7 among legumes; *Evolvulus numularius* (biomass range 10.5-27.8 g/m^2 and IVI range 7.6-23.6 among forbs; and *Fimbristylis miliacea* (biomass range 0-344.1 g/m^2 and IVI range 0-24.0 among sedges (Table 2). However, there was dominancy of only few species in the grassland. Gaston (1994) opined that grassland communities are often represented by a small number of abundant species and a large number of low abundance or less frequent species.

Tsuchida (1983) reported five grassland community types (*Dactyloctenium aegypticum*, *Chrysopogon aciculatus*, *Cynodon dactylon*, *Paspalum scrobiculatum* and *Cyperus rotundus* types) below 1100 m altitude in eastern Nepal. Peet *et al*. (1991) have reported *Sacchrum spontaneum* assemblage in floodplain grasasland; *Imperata cylindrical* - *Naregana porphyrocoma* assemblage in newer river terraces, and *Imperata cylindrica* assemblage in previously cultivated dry sites with well developed soil. The study site from the value of biomass and IVI is recognized as *Chrysopogon-Imperata-Desmodium* community.

Almost all species of the summer were palatable to mild palatable to cattle in comparison to rainy and winter season. A comparison of the protected and grazed grassland in a semiarid region of Jhansi (Shankar *et al.*, 1975) and Varanasi (Singh & Mishra, 1969) indicated that the diversity, in general, increased in the grazed situation. Metera *et al*. (2010) reported that light grazing can be a tool to maintain or enhance biodiversity of grazed areas and contribute to the production of healthy food of high quality. *Ageratum conyzoides*, *Euphorbia hirta*, *Ixeris polycephala*, *Parthenium hysterophorus*, *Solanum nigrum* and *Veronica cineria* were unpalatable forbs. Dominance of grazing tolerant and allelochemic *Chrysopogon aciculatus* in the study site indicate over grazed situation.

Rainy season recorded maximum total community biomass (3650.7±19.1 g/m^2) and summer season minimum (175.0±4.1 g/m^2). Density, biomass and IVI in the grassland species closely paralleled the rainfall pattern and soil moisture. All the dominant species had prostrate growth forms with vegetative propagation in addition to sexual reproduction as reported earlier by Jha and Jha (2000) and Niroula and Mandal (2006). Seasonally, contribution to total community biomass and IVI by different community was variable. Maximum percent contribution by biomass and IVI of grasses was in winter season (90.3 and 76.2); sedges (17.1 and 19) and legume (12.6 and 15) in rainy season while that of non legume was in summer season (7.5% and 15.7%) to the total community biomass and IVI, respectively. Sedges (1.8 and 3.8) and legumes (0.6 and 4.6) had least percent contribution in summer season while those of grasses

(68.8 and 54.9) and non legumes (1.5 and 11.1) were in rainy season to the total community biomass and IVI respectively (Table 3).

In a grazing ecosystem, domestic and wild animals impact the primary producer compartment directly and other components indirectly such as decomposers, soil mineral cycling etc. indirectly (Shankar & Singh, 1996). Output from the existing grassland can be enhanced through protection from overgrazing, appropriate management of defoliation, optimum soil hydration through accumulation of water conserving organic matter in soil, irrigation and application of fertilizers. Further, conservation and evaluation of native forage species for the better yield, quality, and persistence under various grazing management practices are also required for improving the pastures.

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