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Phytosociological Studies of Winter Migratory Grazing Site in Himachal Pradesh, India

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Abstract

The study on phytosociology of winter grazing site was conducted at three different altitudinal locations in Bilaspur district of Himachal Pradesh to have preliminary information about the existing flora. The grazing site has been exploited by the migratory graziers who shaft with their herds of sheep and goats to these grazing lands during winter and higher pastures during summer months. The winter grazing site remains under heavy pressure when migratory graziers stay over there for 4—5 months temporatily during winter months. The present studies consist of working out basal area, relative frequency, dominance and density of different floral components including trees, shrubs, herbs and grasses and finally calculating their importance value index (IVI) to know the dominant, co-dominant and rarely distributed species at the study site. The species diversity was also calculated to find out richness of particular vegetational components (trees, shrubs, herbs and grases) at different altitudinal locations.

Key words : Migratory graziers, Grazing lands, Phytosociological study, Species diversity.

The economy of hilly states like Himachal Pradesh is largely dominated by the agro-pastoral nature of inhabitants. Besides agriculture, every family has live stock component based on their requirements at their homes but some keep large flocks/herds of sheep, goats and buffalos and move to a considerable distance between high altitude pastures during summer and grazing grounds in the Shiwaliks during winters every year. These semi-nomadic or transhumant groups called gujjars with cattles and gaddis with sheep and goats. They have developed a sophisticated system that can optimize the available pastures in the region by migrating through the adverse climatic zones of the state. The climate, topography, physiographic factors, altitude and related factors affect grass land production both quantitatively and qualitatively. Natural grass lands in Himachal Pradesh are spread over 300—4,000 m altitude constituting about 35.74% area under permanent pastures and grazing lands (1). The improvement of these grasslands calls for immediate attention and requires information on floristic composition as a basic tool. Productivity of these grazing lands is to be sustained by proper management and reducing the grazing pressure.

Methods

The present study was undertaken in Bilaspur district (31°12′30′′ and 31°35′30′′N latitude, 76°23′45′′ and 76°55′40′′ E longitude) of Himachal Pradesh, India. The sampling plots were selected purposely at three places i.e. Bassi (500 m amsl) BS_1, Shahtalai (800 m amsl) BS_2 and Naina Devi (1100 m amsl) BS_3. These sampling plots were selected at places where the most of migratory graziers stay during winter with herds/flocks of their sheep and goats. Climate of the winter grazing site is generally sub-tropical. Winters last from October to February and characterized by heavy frost in lower and snow at higher reaches. Growth period starts from May upto September. Geology of the area in dominated by sand and stone with exception having calcareous quartzites or lime stone at higher elevation. At large, soil is poor in humus and nutrients because of severe soil erosion and heavy biotic interferences.

At each selected place 0.1 ha area was taken up for study where quadrates of 10 × 10 m^2, 5 × 5 m^2 and 50 × 50 cm^2 were laid out for trees, shrubs and grasses/herbs respectively, applying North West Corner method (2). The observations were recorded during

Table 1. Phtysociological attributes of trees and shrubs at winter grazing site.

	Density stem/ha			Frequency (%)			Basal area (cm^2/m^2)			Important value index		
	BS_1	BS_2	BS_3	BS_1	BS_2	BS_3	BS_1	BS_2	BS_3	BS_1	BS_2	BS_3
Tree Species												
Fodder Species												
Acacia catechu	80.00	200.00	80.00	60.00	80.00	40.00	5.39	14.13	3.35	45.35	69.98	25.32
Aegle marmelos	60.00	20.00	120.00	40.00	40.00	60.00	2.24	0.57	3.35	27.87	10.91	34.28
Anogeissus latifolia	80.00	–	140.00	40.00	–	80.00	9.24	–	19.94	50.17	–	77.49
Bauhinia variegata	–	120.00	20.00	–	60.00	20.00	–	7.49	0.09	–	42.00	6.72
Celtis australis	–	60.00	–	–	60.00	–	–	0.87	–	–	20.25	–
Emblica officinalis	60.00	–	60.00	50.00	–	40.00	1.53	–	1.13	28.68	–	17.98
Ficus bengalensis	20.00	20.00	–	20.00	40.00	–	1.53	2.29	–	13.33	14.57	–
Flacourtia indica	20.00	60.00	–	20.00	60.00	–	0.29	1.59	–	9.87	21.78	–
Grewia optiva	–	40.00	60.00	–	60.00	20.00	–	0.87	0.16	–	17.69	11.75
Morus alba	20.00	–	40.00	20.00	–	40.00	0.80	–	3.35	11.22	–	20.45
Toona ciliata	40.00	20.00	100.00	40.00	40.00	90.00	1.72	0.37	4.91	22.79	10.49	41.22
Non-Fodder Species												
Dalbergia sissoo	160.00	80.00	180.00	80.00	40.00	80.00	14.90	4.07	8.49	90.83	26.06	57.05
Pinus roxburghii	–	160.00	20.00	–	80.00	20.00	–	14.81	0.45	–	66.26	7.52
Shrubs												
Fodder Species												
Berberis lycium	1.00	0.40	0.80	20.00	10.00	20.00	0.24	0.07	0.15	11.55	8.44	11.35
Carissa spinarum	1.70	2.30	7.70	20.00	50.00	60.00	0.39	0.84	3.07	14.56	55.35	85.80
Indigofera pulchella	3.60	–	1.50	20.00	–	10.00	0.92	–	0.15	23.75	–	10.40
Mallotus philippi-ninsis	–	–	1.20	–	–	20.00	–	–	0.11	–	–	10.40
Mimosa rubicaulis	1.10	–	0.90	10.00	–	20.00	0.13	–	0.23	7.60	–	12.83
Nyctanthus arbor-tristis	0.80	–	–	10.00	–	–	0.03	–	–	5.83	–	–
Rosa moschata	0.50	–	0.50	10.00	–	10.00	1.01	–	0.07	4.94	–	5.95
Rubus ellipticus	0.90	0.90	0.40	20.00	20.00	10.00	0.22	0.17	0.04	11.05	18.26	5.21
Woodfordia fruticosa	2.20	3.90	3.80	30.00	60.00	50.00	0.72	1.93	1.56	27.96	95.33	49.93
Ziziphus mauritiana	2.40	1.60	1.60	40.00	30.00	20.00	2.38	0.54	0.35	36.81	35.99	16.68
Non-Fodder Species												
Adhatoda vasica	4.00	0.50	2.40	40.00	10.00	10.00	2.41	0.04	0.46	41.77	8.47	17.50
Dodonea viscosa	4.90	1.10	3.10	30.00	20.00	20.00	1.66	0.18	0.67	35.99	19.91	25.96
Lantana camara	7.80	1.10	3.70	10.00	10.00	20.00	5.05	0.16	0.66	67.24	15.46	27.87
Murraya koenighii	2.70	2.20	1.70	10.00	40.00	30.00	0.83	0.51	0.17	11.02	43.20	18.01

July and August, the peak period of migratory grazing. The phytosociological parameters like percent frequency, basal area and species diversity were calculated following Raunkier (3), Hanson and Churchill (4) and Margalef (5), respectively. Relative dominance, relative density and relative frequency were calculated to find out importance value index (IVI) adopting the procedure given by Phillips (6).

Results and Discussion

Table 1 reveals the dominance of *Dalberbgia sissioo* (IVI 90.83), *Acacia catechu* (IVI 69.98) and *Anogeissus latifolia* (IVI 77.49) at Bassi (BS_1), Shahtalai (BS_2) and Naina Devi (BS_3) respectively. *Toona ciliata, Flacourtia indica* and *Bauhinia variegata* were the rarely distributed species in the respective sample plots. The dominance of tree species may be attributed to their large density (stems/ha), high percent frequency and basal area. Among the shrub species *Lantana camara* (IVI 167.24), *Woodforadia fruticosa* (IVI 95.33) and *Carissa spinarum* (IVI 85.80) registered their dominance at BS_1, BS_2 and BS_3 respectively. The least occurring

Table 2. Phytosociological attributes of herbs and grasses at winter grazing site.

	Density stem/ha			Frequency (%)			Basal area (cm^2/m^2)			Important value index		
	BS_1	BS_2	BS_3	BS_1	BS_2	BS_3	BS_1	BS_2	BS_3	BS_1	BS_2	BS_3
Herb Species												
Fodder Species												
Achyranthus aspera	4.20	4.70	4.70	30.00	20.00	25.00	17.86	2.57	3.44	40.95	21.42	26.19
Capsella bursapastoris	5.00	–	3.20	20.00	–	15.00	4.93	–	1.26	22.03	–	14.86
Crotaleria sericea	5.50	–	3.50	15.00	–	15.00	3.30	–	0.87	18.56	–	14.68
Clematis grata	0.90	–	–	10.00	–	–	0.31	–	–	5.73	–	–
Desmodium trifolium	–	–	4.50	–	–	15.00	–	–	0.71	–	–	16.29
Decliptera bupleuroides	6.00	1.30	3.60	20.00	10.00	15.00	6.75	1.96	2.03	25.37	9.84	17.14
Fumeria parviflora	–	2.20	2.90	–	5.00	15.00	–	0.22	1.44	–	658	14.65
Geramone spp.	12.00	–	–	15.00	–	–	2.77	–	–	27.26	–	–
Medicago dentifulata	3.60	11.90	1.80	10.00	50.00	15.00	4.95	31.09	3.25	15.26	92.72	16.07
Micromeria biflora	18.80	10.20	4.20	30.00	25.00	10.00	15.39	4.55	0.57	59.67	36.87	13.36
Rumex nepalensis	–	4.90	–	–	10.00	–	–	1.10	–	–	15.12	–
Sida veronicifolia	4.60	2.80	2.90	10.00	40.00	20.00	7.09	14.52	2.63	24.07	45.46	18.86
Sonchus oleraceus	–	4.40	12.70	–	15.00	35.00	–	1.59	26.07	–	17.15	90.41
Non-Fodder Species												
Aerva scandens	2.10	1.40	–	15.00	10.00	–	4.33	0.23	–	14.93	7.29	–
Ageratum conyzoides	4.20	1.80	3.00	25.00	20.00	30.00	11.77	1.89	6.05	31.37	15.00	30.10
Cryptolepis beuchianeni	–	–	0.70	–	–	10.00	–	–	0.24	–	–	5.99
Plectranthus rugosus	–	–	3.00	–	–	10.00	–	–	1.75	–	–	13.36
Roylea spp.	1.00	3.40	1.30	5.00	10.00	10.00	1.07	0.61	0.91	4.95	11.58	8.47
Trichodesma indica	1.70	–	–	10.00	–	–	2.49	–	–	9.89	–	–
Murraya koenighii	–	5.20	–	–	15.00	–	–	3.08	–	–	20.97	–
Grasses Species												
Apluda mutica	29.90	14.10	16.60	50.00	15.00	25.00	29.84	2.82	3.58	65.59	7.65	23.59
Cenchrus ciliaris	5.40	9.20	14.50	10.00	10.00	25.00	0.54	0.90	4.02	7.50	10.38	22.88
Chrysopogon gryllus	9.00	10.80	17.60	15.00	10.00	25.00	1.12	1.72	4.60	12.12	12.35	25.65
Cymbopogon martini	8.70	11.10	5.60	15.00	15.00	15.00	3.52	2.90	1.23	24.25	16.08	10.11
Chmbopogon distans	4.00	21.50	5.10	5.00	30.00	15.00	0.50	12.04	0.78	4.80	39.68	9.17
Cynodon dactylon	14.50	2.30	7.10	45.00	10.00	25.00	13.85	0.97	4.87	38.57	6.63	19.35
Fimbristylis camplanata	–	19.30	10.30	–	20.00	20.00	–	6.30	2.90	–	27.05	17.04
Heteropogon contortus	–	6.70	–	–	10.00	–	–	0.99	–	–	9.21	–
Impreta cylidrica	7.00	4.70	6.90	10.00	10.00	10.00	1.23	0.63	0.78	9.77	7.53	8.71
Panicum antidotale	1.60	–	0.70	10.00	–	10.00	1.10	–	0.71	5.64	–	4.66
Pennisetum arvense	–	35.20	–	–	55.00	–	–	33.68	–	–	85.72	–
Saccharum spontaneum	38.20	9.50	16.60	60.00	15.00	25.00	40.11	2.45	5.80	84.19	14.60	26.68
Sorghum helepense	10.40	19.20	8.00	15.00	25.00	10.00	3.87	9.02	1.25	15.66	32.61	10.02
Enmeda anathera	15.70	8.80	40.30	20.00	10.00	70.00	3.95	1.72	39.47	20.86	11.23	103.14
Ochloa sapnoides	13.90	6.40	6.00	25.00	10.00	20.00	4.18	1.15	1.99	20.85	9.15	13.08
Fox tail grass	–	–	0.20	–	–	15.00	–	–	0.48	–	–	6.78

shrub species were *Rosa moschata, Berberis lycium* and *Rubus ellipticus* with their IVI value of 4.94, 8.44 and 5.21 respectively, at Bassi (S_1), Shahtalai (S_2 and Naina Devi (S_3) sample plots.

Table 2 indicates the dominance of *Micromeria biflora* (IVI 59.67), *Medicago denticulata* (IVI 92.72) and *Sonchus oleraceus* (IVI 90.41) species of berbs at BS_1, BS_2 and BS_3 respectively. The rare occurring

Table 3. Species diversity at winter migaratory grazing site (district Bilaspur). BS_1 = Bassi, BS_2 = Shahtalai, BS_3 = Naina Devi. Values in parentheses represent richness of respective component at that sample plot.

Floriatic component	Graizing site BS_1	BS_2	BS_3	Mean
Trees	0.90 (9.0)	0.90 (10.0)	1.00 (10.0)	0.94 (9.67)
Shrubs	0.99 (13.0)	0.83 (9.0)	0.98 (13.0)	0.93 (11.66)
Herbs	1.03 (13.0)	0.94 (12.0)	0.93 (14.0)	0.97 (13.0)
Grasses	0.91 (12.0)	1.00 (14.0)	0.93 (14.0)	0.96 (13.33)

herb species identified were *clematis grata, Fumaria Parviflora* and *Micromeria biflora* at the respective sample plots.

Among the grasses the dominant species were *Sacharum spontaneum* (IVI 84.19), *Pennisetum arvense* (IVI 85.72) and *Themeda anathera* (IVI 103.14) at Bassi, shahtalai and Naina Devi respectively (Table 2). *Cymbopogon distans, Cynodon dectylon* and *Penicum antidotale* registered least appearance in these sample plots. Again, the dominance and the rare distribution of the species may be attributed to relative value of frequency, basal area and IVI which further depend on the grazing pressure and preference of animals for the species coupled with microclimatic condition of the niche.

Data regarding the species diversity in different sample plots at the winter grazing site are presented in Table 3. The species diversity (Shanon's index of general diversity) at Naina Devi was registered to be highest (1.0) followed by Bassi and Shahtalai (0.9 each),shrubs diversity was recorded to be maximum at Bassi (0.99) and lowest at Shahtalai (0.83). Similarly, highest herbs and grass diversity was recorded at Bassi (1.03) and Shahtalai (1.0) whereas the lowest at Naina Devi (0.93) and Bassi (0.91), respectively. The idea behind calculating the species diversity was to assess adaptability of the species to a particular micro-climate. The minor differences in diversity among same vegetational component (tree/shrubs/herbs/grasses) at different sample plots may be ascribed to different climatic conditions at micro-level. There has been many claims that species diversity confers stability in natural ecosystems after approaching monoculture may be unstable (7).

Conclusion

The site faces heavy grazing pressure causing deterioration to its vegetation and soil. Out of total existing trees, shrubs and herbs only 85, 71 and 61% of species, respectively, have been identified as fodder species. So, the site needs to be reclaimed by introducing some species of good fodder value and removing the non-fodder ones in a phased manner. This will not only provide sustainable fodder supply without deteriorating site conditions but also help in maintaining the age old practice of migratory grazing. Further, it needs some administrative measures to regulate graziers inflow and carry out some scientific studies especially on carrying capacity, soil, water conservation and adaptaptation of new introduction/species.

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