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Vegetation structure in summer of Tehsil Takht-e-Nasrati plains, district Karak, Pakistan

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Community structure is a key marker of long-term vegetation change in ecosystem. In the present investigation, 11 plant communities were recorded in plains area. The cluster analysis gives rise to 5 groups on the basis of important value and 4 groups on basis of soil. The vegetation changed with change of distance. As a whole in plains, the CZS community was developed. There were 6 tree, 7 shrub and 19 herb species. The Importance value contributed by three dominants species was 79.5. The contribution by tree was 50.6, shrubs (IV = 62.06) and herbs (IV = 187.3). The soil texture was found from sandy clay to sandy clay loam. These results emphasize the continuous need for long-term ground-based ecological monitoring in conjunction with satellite-based monitoring of changes in vegetation cover.

Key words: Altitudinal effect, community, soil, plains, life form, leaf size classes.

INTRODUCTION

Recent ecological studies in semi-arid rangelands have shown that developing sustainable agriculture will depend on an improved understanding of the chronological variability characterizing semi-arid ecosystems (Khan, 2012). Ecological reviews (Khan et al., 2013; Khan and Hussain, 2013) portray semi-arid ecosystems as constantly variable vegetation mosaics changing in response to the ecological 'driving forces' of rainfall and grazing levels. These studies also report that reliable and relevant information on vegetation change is required to quantify the effects of this complex of interacting processes and formulate theories of ecosystem dynamics. The research area is characterized by low productivity, high intensity of solar radiation and high degree of resource seasonality (Khan et al., 2011). The vegetation of this fragile biome is adapted to the insignificant conditions occurring with thin populations. Low altitude grazing plains are very important being a wild life habitat, water catchment and a livelihood source for nomadic and transhumant inhabitants. The community structure and distribution patterns of research area have not been given due attention by the plant ecologists, and hence are poorly understood (Khan, 2012). The distribution and community structure of vegetation is governed by adverse edaphic and climatic factors; mainly by rainfall and redistribution of ground water that decrease with the increase in altitude. Temperature is also one of the most important limiting factors controlling

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Abbreviations: RD, Relative density; **RF,** relative frequency; **RC,** relative cover; **CSP,** *Cenchrus-Saccharum-Prosopis*; **ECP,** *Eragrostis-Calotropis-Prosopis* community; **PSC,** *Phoenix-Saccharum-Cenchrus;* **APS,** *Aerva-Prosopis-Saccharum*; **TPS,** *Tribulus-Prosopis-Saccharum*; **EC,** electrical conductivity; **CZS,** *Cenchrus-Zizyphus-Saccharum*; **CSA,** *Cenchrus-Saccharum-Acacia*; **ZCS,** *Zizyphus-Cenchrus-Saccharum*; **SCZ,** *Saccharum-Cenchrus-Zizyphus*; **CCA,** *Cenchrus-Calligonum-Acacia*; **ZCC,** *Zizyphus-Cenchrus-Calligonum* community.

the distribution and community structure of vegetation in research area. Here the altitude has much greater effect on temperature than latitude. Mean annual temperature decrease with increase in elevation, more rapidly in summer than in winter. This altitude based temperature gradient is the vital factor shaping the vegetation types and determining their diversity and distribution (Heaney and Proctor, 1989; Tanner et al., 1998; Vazquez and Givnish, 1998). Hilly areas are characterized by scanty rainfall, high ultraviolet (UV) radiation, high wind velocity, blizzards, low temperature and snowstorms. The plants of this zone show an adaptation to these conditions and are generally dwarfed, stunted, wooly or spiny, and develop a mosaic patch of different forms. They possess an early growth initiation with a short vegetative period ranging from several days to a few months. The community as a whole usually exhibits seasonal fluctuations, and its structure and composition are strongly influenced by the extent to which periodic phenomena in the individuals are adjusted to each other (Khan et al, 2012a). In Tehsil Takht-e-Nasrati, the plains cover 50% (Khan et al., 2011). These areas are used for grazing during March to October. The research areas are severely degraded due to nomadic and sedentary livestock overgrazing. Due to huge population increases and increasing urbanization practices, existing reserve forests and grazing lands are overburdened with community rights making it impossible to reduce the grazing pressure (Khan and Hussain, 2012). Grazing practices are one of the important determinants of vegetation distribution patterns and having most obvious impact on the floral biodiversity of an area (Vallentine, 2001). Many researchers (Stewart, 1961; Negi, 1995; Sardar, 1997; Stainton, 1998; Shinwari and Gillani, 2002; Khan and Hussain, 2013) have studied different aspects of vegetation structure and distribution patterns in different parts of Pakistan. Phytosociology is an invaluable method for vegetation survey and assessment involving investigation of characteristics of plant communities using simple and rapidly employing field techniques (Rieley and Page, 1990). In the present study, an effort has been made to investigate and analyse correlation of vegetative attributes with key environmental factors.

Research area

The Tehsil Takht-e-Nasrati (32.47^{o} - 33.28^{o} North, 70.30^{o} - 71.30^{o} East) of about 613.66 sq kilometers is bound by Tehsil Banda Dawood Shah on the North West, Tehsil Karak on the North East, District Mianwali and District Lakki Marwat on the South East, and Tribal area Adjoining District Bannu on the South West (Figure 1). The majority of the area consists of rigged dry hills and rough fields of about 323.97 Sq. kilometers and agriculture land of about 289.7 Sq. kilometer. Rain agriculture is major income source of the people. The area is situated at 340 m above sea level. Environmental data showed that mean air temperature (39.5°C) and wind speed (5.5 Km/h) was high in June, relative humidity was high (77.21%) in month of September, rainfall (121.6 mm) and soil temperature (26.77°C) was high in month of July, which indicated dry condition in area. This also caused deviation in vegetation structure (Table 1).

MATERIALS AND METHODS

The phytosociological studies at Tehsil Takht-e-Nasrati were carried out in the summer of 2010 and 2011.

Quadrat method

Quadrat method was used to study and analyse the vegetation dynamics as well as to collect the primary data for statistical analyses. A total of 22 sites were chosen in the study area, where a stand of ten quadrats were set up in each selected sites having best representation of floral biodiversity and geographic extent of the area.

Vegetation attributes

Vegetation attributes including frequency, density and cover were recorded along with environmental coordinates like latitude, longitude, altitude and slope using global positioning system (GPS). The importance value of each species was compiled adding relative density (RD), relative frequency (RF) and relative cover (RC) following Hussain (1989).

Community names

On the basis of the highest importance values of the first three dominant species from each layer, the communities were established and named. Plants from the premises of sampling points as well as isolated vegetation patches were also collected to record maximum number of species and their distribution patterns.

Identification of species

Collected samples were pressed, dried and transported to herbarium of University of Peshawar Khyber Pakhtunkhawa, Pakistan, where they were identified and classified following Stewart (1961) and Nasir and Ali (1972).

Edaphology

Two kg soil sample was collected from 11 sites of Tehsil Takht-e-Nasrati at a depth of 15 cm depending upon the area situation using the outer periphery of plants canopy or at the centre of plants with the help of soil auger and mixed to make a composite sample. Soil was dried and passed through 2 mm sieve and stored in a polythene bag. There were 5 replicates from each site. These were analyzed for different chemical and physical parameters including soil texture, organic matter, lime contents, pH, electrical conductivity (EC), phosphorus and potassium using standard methods (Bouyoucos, 1962; Hussain, 1989; Jackson, 1962).

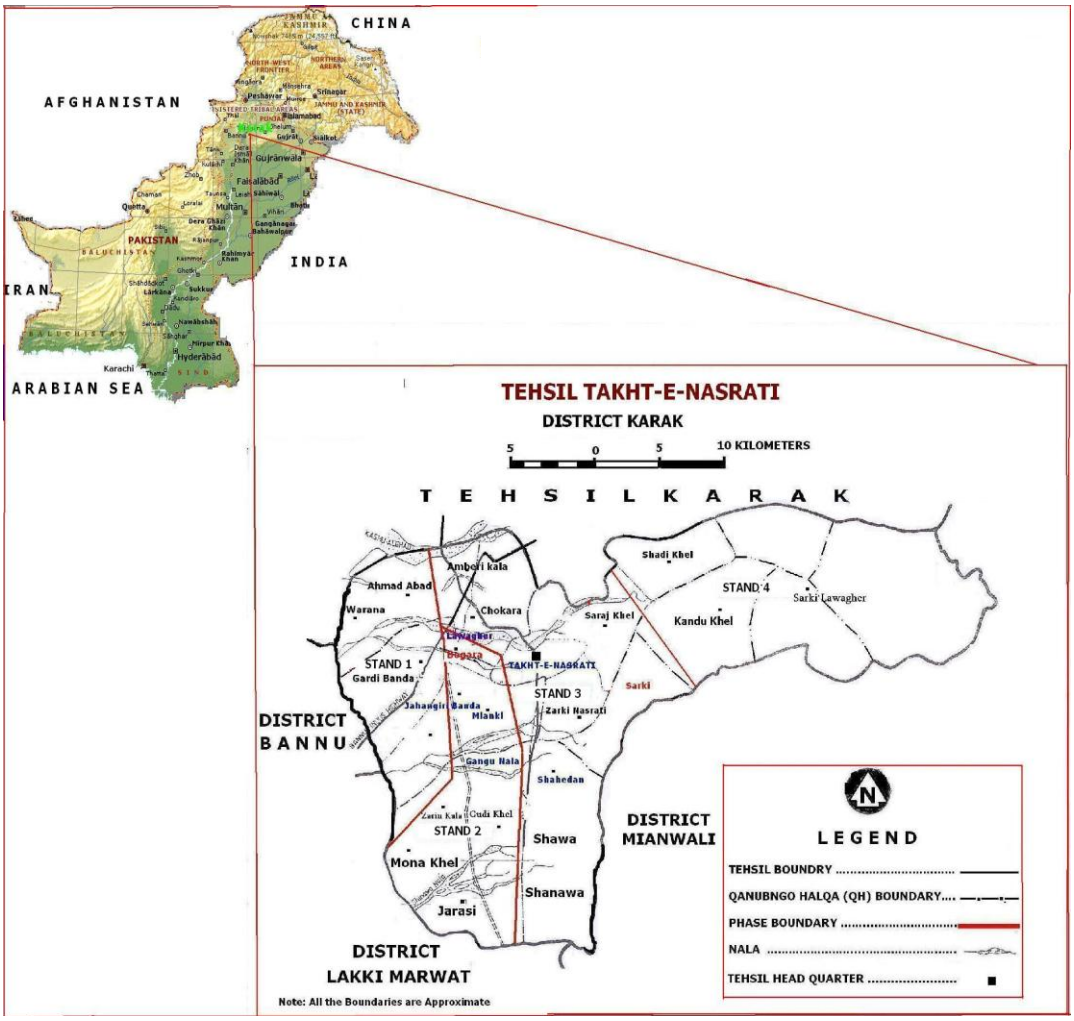

Figure 1. Map of Tehsil Takht-e- Nasrati showing research spots.

Table 1. Meteorological data of Tehsil Takht -e -Nasrati for the year 2001-2010.

Month	Temperature (°C)		Humidity (%)		Rainfall (mm)	Soil temperature (C^o) Average	Wind speed (Km per Hour)
	Max	Min	Max	Min			
January	19.18	4.26	75.80	35.24	27.43	7.03	2.9
February	21.69	7.29	77.39	42.23	37.72	9.14	3.2
March	28.20	12.06	75.38	35.23	37.17	13.89	3.5
April	34.74	17.94	66.12	29.42	36.54	19.02	5.2
May	38.32	22.33	59.66	30.73	31.6	21.87	5.4
June	39.50	25.9	59.96	32.89	74.24	25.78	5.5
July	38.44	25.76	73.33	38.76	121.6	26.77	5.2
August	36.66	25.29	75.68	42.61	108.3	26.37	4.1
September	35.47	21.95	77.21	39.29	61.58	23.49	3.7
October	32.33	16.79	71.55	35.51	15.13	20.09	3.5
November	26.71	10.01	71.56	36.66	5.80	14.10	3.2
December	21.93	5.67	75.20	35.90	15.38	8.96	3.1
Mean	31.1	16.27	71.57	36.21	47.71	18.04	4.04

Source: Agricultural Research Farm Ahmad Wala Karak.

RESULTS

Stand – 1 (340 – 399 m)

In stand 1, collectively 27 plant species consisting of 6 trees, 6 shrubs, 13 herbs and 2 grasses composed the *Cenchrus-Saccharum-Prosopis* (CSP) community. On the basis of area, 4 communities that is, *Eragrostis-Calotropis-Prosopis* community (ECP), *Phoenix-Saccharum-Cenchrus* community (PSC), *Aerva-Prosopis-Saccharum* community (APS) and *Tribulus-Prosopis-Saccharum* community (TPS) were found in Tater Khel, Gardi Banda, Ahmad Abad and Warana, respectively. The highest number of plant species (18) was present in APS and low (14) in PSC. The least number of trees (3) were found in PSC. The number of shrubs (6), herbs (8) and grasses (2) was high in APS, TPS and ECP, respectively. The TIV contributed by three dominant plant species forming a community was high (109) in ECP while low 89.71 in TTS. The highest amount of TIV of tree (64.24) and grasses (61.72) was found in ECP while shrubs (81.85) and herbs (171.5) were found in APS and TTS, respectively (Tables 2 and 3). The details are as follows:

Eragrostis-Calotropis -Prosopis community (ECP)

Eragrostis- Calotropis -Prosopis community was composed of 15 species comprising 4 tree, 4 shrubs, 5 herb and 2 grass species at Tater Khel. The Importance value contributed by the three dominants species that is, *Eragrostis poaeoides, Calotropis procera* and *Prosopis farcta* was 109.09. The contribution by tree was 64.2, shrubs 67.58, herbs 106.49 and grass 61.73. The associated species in herbaceous stratum included *Cenchrus biflorus* (IV=29.12), *Heliotropium europaeum* (IV = 26.14) and *Chrozophora obliqua* (IV = 25.25), *Saccharum bengalense* (IV = 16.51) and *Datura metel* (IV = 10.52) in shrubby stratum. In tree stratum, the important species were *Zizyphus mauritiana* (IV=12.39) and *Phoenix dactylifera* (IV 10.04) (Tables 2 and 3). The community preferred to grow on high percentage of sand (63%) and low amount of silt (6%) and clay (31%) particles. The soil of the community had better calcium carbonate (12.57%) with alkaline soil pH (7.31). The concentrations of P and K content were found in the range of 3.78 and 119.1 mg Kg^{-1}. The community preferred EC in the range of 0.18 dS m^{-1}. The soil texture was found sandy clay loam (Table 4).

Phoenix- Saccharum -Cenchrus community (PSC)

Phoenix–Saccharum-Cenchrus community was present at Gardi Banda. This community was supported by 14 plant species of which there were 3 trees, 4 shrubs, 6 herbs and single grass species. The dominant plant species were *P. dactylifera* (IV = 38. 6) in tree stratum followed by *S. bengalense* (IV = 37. 9) in shrub stratum and *C. biflorus* (IV = 37. 5) in herb stratum. *Z. mauritiana* (7. 67) and *Dalbergia sissoo* (5.14) were associated member in tree stratum. The important species in shrub stratum were *Saccharum spontaneum* (IV = 19. 84) and *C. procera* (IV = 9. 19) (Tables 2 and 3). Ground cover consisted of herbaceous plants had high variety in this period. The community preferred to grow on high percentage of sand (65%) and low amount of silt (3%) and clay (32%) particles. The soil of the community had better calcium carbonate (12.34%) with alkaline soil pH (7.66). The concentrations of P and K content were found in the range of 3.79 and 125.6 mg Kg^{-1}. The community preferred electrical conductivity (EC) in the range of 0.16 dS m^{-1}. The soil texture was found sandy clay loam (Table 4).

Aerva- Prosopis -Saccharum community (APS)

Aerva- Prosopis -Saccharum community was established at Ahmad Abad and is dominated by *Aerva persica* (32. 1), *Prosopis farcta* (31. 62) and *Saccharum spontaneum* (30. 64). The associated species of the tree stratum included *Z. mauritiana* (18. 12) and *Acacia nilotica* (IV = 5. 16). Co dominant species included *C. biflorus* (23.57), *Fagonia cretica* (23.4) and *Peganum hermala* (22. 03) in ground stratum; *S. bengalense* (IV=21.76) and *C. procera* (IV = 10. 08) were making shrubby stratum (Tables 2 and 3). The community was composed of 18 species comprising of 4 tree, 6 shrubs, 7 herb and 1 grass species. The Importance value contributed by the tree was 58.97, shrubs 81.85, herbs 140.8 and grass 18.38. The community preferred to grow on high percentage of sand (70%) and low amount of clay (26%) and silt (4%) particles. The soil of the community had better lime (12.6%) with alkaline soil pH (7.13). The concentrations of P and K content were initiated in the range of 3.77 and 114 mg Kg-1. The community preferred EC and SOM in the range of 0.19 dS m-1 and 1.27%, respectively. The soil texture was found sandy clay loam (Table 4).

Tribulus - Prosopis -Saccharum community (TPS)

TPS community was composed of 17 species comprising 4 tree, 4 shrubs, 8 herb and 1 grass species at Warana. The Importance value contributed by three dominants species that is, *Tribulus terrestris, P. farcta* and *S. bengalense* was 89.68 while total importance value of 210.32 was provided by the remaining species. Associated species included *Carthamus oxycantha* (IV=28.9), *Cyperus rotundus* (IV = 28.6), *C. biflorus* (IV = 26.7) of ground stratum and *P. aphylla* (IV=22.4) and *C. procera* (IV = 10.7) were making shrubby stratum. The

Table 2. The number of species and share relative importance value of tree, shrubs, herbs, and grasses among the different communities during summer of Takht-e- Nasrati, District Karak.

Stand	Site	Community	Total species	Tree	Shrub	Herbs	Grasses	TIV contribution by three dominant	TIV by remaining species	TIV by tree	TIV by shrubs	TIV by herbs	TIV by grasses
1	As a whole	CSP	27	6	6	13	2	79.09	220.91	56.35	73.03	142.5	27.97
	Tater Khel	ECP	15	4	4	5	2	109	191	64.24	67.52	106.52	61.72
	Gardi Banda	PSC	14	3	4	6	1	108.41	191.59	51.37	75.4	151.45	21.78
	Ahmad Abad	APS	18	4	6	7	1	94.34	205.66	58.97	81.85	140.8	18.38
	Warana	TTS	17	4	4	8	1	89.71	210.29	50.95	67.57	171.5	9.98
2	As a whole	ZCS	27	4	5	15	3	86.64	213.36	47.21	55.77	158.99	37.9
	S Bogara	ESZ	24	4	4	14	2	71.36	228.64	30.67	52.53	172.9	43.9
	N Bogara	TAS	19	4	4	10	1	94.91	205.09	46.34	47.07	181.47	25.12
	Gandiri Khattak	ZCS	17	1	3	11	2	156.98	143.02	81.9	49.98	136.5	31.62
	Kiri Dhand	CTZ	19	3	5	9	2	82.78	217.22	25.84	65.45	159.88	48.83
	Jahangiri Banda	CCZ	21	3	4	12	2	93.23	206.77	32.61	70.55	165.04	31.8
	Mona Khel	ZCS	17	3	4	9	1	113.84	186.16	71.56	48.95	156.83	22.66
	Jarasi	SZC	19	3	4	10	2	88.79	211.21	41.69	55.89	140.96	61.46

Table 3. The number of species and share relative importance value of tree, shrubs, herbs and grasses among the different communities during summer of Takht-e- Nasrati, District Karak.

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Group	Spp. no	Species	ECP	PSC	APS	TPS	ESZ	TAS	ZCS	CTZ	CCZ	ZCS	SZC	Mean	Average
1	1	*Acacia nilotica* (L.) Delice.	7.52	0	5.16	3.56	2.64	27.1	0	6.68	3.73	3.21	6.01	5.96	70.8
	31	*Tribulus terrestris* L.	0	30.5	14.17	32.2	13.6	41.8	19.8	32.9	13.9	0	9.81	19	
	3	*Boerhaavia diffusa* L.	0	11.4	0	23.8	8.07	11.7	10.1	20.9	10	11.7	11.6	10.8	
	12	*Cyperus rotundus* L.	0	0	0	28.6	9.34	13.9	0	21.9	13.5	16.7	18.3	11.1	
	23	*Periploca aphylla* Decne.	5.18	8.5	4.65	22.4	5.42	4.81	4.99	12	5.12	0	7.08	7.29	
	30	*Tamarix aphylla* (L.) Karst.	0	0	0	5.6	0	0	0	0	0	0	0	0.51	
	6	*Carthamus oxycantha* Bieb.	10.9	32.1	0	28.9	8.95	9.07	8.88	9.02	5.36	3.57	0	10.6	
	24	*Phoenix dactylifera* L.	10	38.6	0	0	9.52	2.45	0	0	0	0	0	5.51	
2	4	*Calligonum polygonoides* L.	0	0	0	0	20.2	6.5	0	35.3	42.5	13.5	0	10.7	57.64
	17	*Euphorbia helioscopia* L.	0	15.8	13.21	7.99	28.9	21.8	5.43	13.4	22.5	30.5	0	14.5	
	15	*Echinops echinatus* D.C.	0	0	0	0	20.6	0	5.88	0	0	0	0	2.41	
	9	*Citrullus colocynthis* L. Schrad.	0	0	0	0	6.79	4.9	0	0	15.6	16.6	19.7	5.78	
	13	*Dalbergia sissoo* Roxb.	0	5.14	4.11	0	3.19	4.58	0	4.49	8.39	9.76	13.9	4.87	
	18	*Euphorbia prostrata* Ait.	15.1	0	0	0	19.1	22.6	12.9	0	21.8	27.3	17.4	12.4	
	10	*Cymbopogon jwarancusa* (Jones) Schult.	0	0	0	0	0	0	0	20.5	0	0	0	1.86	
	29	*Solanum surattense* Burm .f.	0	0	12.16	0	2.94	0	7.1	14.5	3.54	3.43	12.6	5.12	

Table 3. Contd.

Group	Spp. no	Species	ECP	PSC	APS	TPS	ESZ	TAS	ZCS	CTZ	CCZ	ZCS	SZC	Mean	Average
3	7	*Cenchrus biflorus* Hook. f.	29.1	37.5	23.57	26.7	23.9	38.2	39.2	26.5	30.2	37.5	27.5	30.9	80.79
	27	*Saccharum bengalense* Retz.	16.5	37.9	21.76	26	21.44	26.1	36	6.87	17.7	24.6	25.9	23.7	
	21	*Launaea nudicaulis* (L.) Hook. f.	0	0	0	0	0	0	9.4	0	0	0	4.74	1.29	
	32	*Zizyphus mauritiana* Lam.	12.4	7.67	18.12	10.8	15.34	12.3	81.8	14.6	20.5	58.6	21.8	24.9	
4	2	*Aerva persica* (Burm.f) Merrill.	0	24.2	32.1	7.77	5.13	0	0	0	4.8	0	9.21	7.56	25.8
	28	*Saccharum spontaneum* L.	0	19.8	30.64	0	0	0	0	0	0	0	0	4.59	
	26	*Ricinus communis* L.	0	0	8.8	0	0	0	0	0	0	0	0	0.8	
	19	*Fagonia cretica* L.	0	0	23.4	15.2	7.01	0	7.4	0	8.34	9.6	10	7.36	
	22	*Peganum hermala* L.	0	0	22.03	0	13.7	8.6	0	0	15.6	0	0	5.45	
5	5	*Calotropis procera* (Wild) R.Br.	35.4	9.19	10.08	10.7	5.52	9.61	9.12	4.38	5.12	6.13	10.6	10.5	64.97
	8	*Chrozophora obliqua* (Vahl) A. Juss.	25.3	0	0	0	4.9	8.88	0	12.3	0	0	0	4.67	
	20	*Heliotropium europaeum* L.	26.1	0	0	0	0	0	10.4	8.53	0	0	0	4.09	
	11	*Cynodon dactylon* (L.) Pers	22.3	0	0	0	9.2	0	18.4	0	13.6	0	20.4	7.63	
	16	*Eragrostis poaeioides* Beauv.	39.4	21.7	18.38	9.96	34.6	25.1	13.2	28.4	18.2	22.7	41.15	24.8	
	14	*Datura metel* L.	10.5	0	6.04	8.32	0	0	0	6.83	0	4.6	12.3	4.42	
	25	*Prosopis farcta* (Banks & Sol.) J.F. Macbr.	34.3	0	31.62	31.5	0	0	0	0	0	0	0	8.86	

Table 4. Physiochemical analysis of soil of Tehsil Takht-e-Nasrati, District Karak.

Group	Site	Community	pH (1:2)	EC dS m-1 (1:2)	Lime (%)	SOM (%)	P mg/Kg	K mg/Kg	Sand	Clay	Silt	Textural class
A	Tater Khel	ECP	7.31	0.18	12.6	1.24	3.78	119	63	31	6	Sandy clay loam
	Gardi Banda	PSC	7.66	0.16	12.3	1.26	3.79	126	65	32	3	Sandy clay loam
	Warana	TTS	8.13	0.21	12.4	1.28	3.76	121	61	33	6	Sandy clay loam
	Jahangiri Banda	CCZ	6.83	0.16	12.6	1.25	3.81	123	62	34	4	Sandy clay loam
	Gandiri Khattak	ZCS	6.97	0.18	12.7	1.29	3.64	117	67	30	3	Sandy clay loam
B	Ahmad Abad	APS	7.13	0.19	12.6	1.27	3.77	114	70	26	4	Sandy clay loam
	S Bogara	ESZ	6.86	0.17	12.6	1.31	3.67	123	72	24	4	Sandy clay loam
	Mona Khel	ZCS	6.19	0.19	12.7	1.26	3.67	125	63	32	5	Sandy clay loam
C	N Bogara	TAS	6.72	0.18	12.7	1.44	3.68	116	51	43	6	Sandy clay
D	Kiri Dhand	CTZ	6.43	0.19	12.6	1.33	3.79	120	45	28	27	Clay loam
	Jarasi	SZC	6.06	0.17	12.7	1.2	3.84	127	42	25	33	Loam

associated species of the tree stratum *Zizyphus mauritiana* (IV =10.87) and *Tamarix aphylla* (IV = 5.6) (Tables 2 and 3). The community preferred to grow on high percentage of sand (61%) and low amount of clay (33%) and silt (6%) particles. The soil of the community had better lime content (12.4%), SOM (1.28%), EC (0.21 dS m^{-1}), P (3.76 mg Kg^{-1}) and K (121 mg Kg^{-1}) with alkaline soil pH (8.13). The soil texture was found sandy clay loam (Table 4).

Stand – 2 (400 – 499 m)

In this stand, 7 communities of 45 plant species comprising 4 trees, 5 shrubs, 32 herbs and 4 grasses that structured *Cenchrus-Zizyphus-Saccharum* community (CZS). The *Cenchrus-Saccharum-Zizyphus* community (CSZ) was found in Southern area of Bogara, *Cenchrus-Saccharum-Acacia* community (CSA) in Northern area of Bogara, *Zizyphus-Cenchrus-Saccharum* community (ZCS) in Gandiri Khattak, *Saccharum-Cenchrus-Zizyphus* community (SCZ) in Kiri Dhand, *Cenchrus-Calligonum-Acacia* community (CCA) in Jahangiri Banda, *Zizyphus-Cenchrus-Calligonum* community (ZCC) in Mona Khel and *Cenchrus-Zizyphus-Saccharum* community (CZS) in Jarassi.

The highest number of species (30) was present in CSZ. The highest number of trees (4) was found in CSZ and CSA while the highest number of shrubs and herbs in SCZ and CSZ, respectively. The highest TIV contributed by three dominant species was 200.63 in ZCS at Gandiri Khattak while low 89.90 in SCZ at Kiri Dhand. Furthermore, the highest TIV contributed by trees (93.70), shrubs (90.29), herbs (134.58) and grasses (90.94) in ZCS, CCA, SCZ and CSA respectively (Tables 2 and 3).

***Eragrostis -Saccharum -Zizyphus* community (ESZ)**

Eragrostis- Saccharum -Zizyphus community was established at Southern area of Bogara and composed of 24 species consisted of 4 tree, 4 shrubs, 14 herb and 2 grass species. This community was dominated by *E. poaeoides* (IV = 34.6) in herb strata, *S. bengalense* (IV = 21.4) in shrubby strata and *Z. mauritiana* (IV=15.3) in tree strata. The importance value contributed by tree strata was 30.67, shrubby strata (IV = 52.56) and herbaceous strata (IV = 216.77) (Tables 2 and 3). The community preferred to grow on high percentage of sand (72%) and low amount of clay (24%) and silt (4%) particles. The soil of the community had better lime contents (12.6%) with soil pH (6.86). The concentrations of P and K content were initiated in the range of 3.67 and 123 mg Kg^{-1}. The community preferred EC and SOM in the range of 0.17 dS m^{-1} and 1.31% respectively The soil texture was found sandy clay loam (Table 4).

***Tribulus –Acacia- Saccharum* community (TAS)**

Tribulus-Acacia-Saccharum community was developed at Northern area of Bogara and was dominated by *Tribulus terrestris* (IV = 41.8) in herbaceous strata, *A. nilotica* (IV = 27.1) in tree strata and *S. bengalense* (IV = 26.1) in shrubby strata. *E. poaeoides* was the second leading dominant associate of herbaceous strata with (IV = 25.1). This community was supported by 19 plant species including 4 tree, 4 shrubs, 10 herb and 1 grass species (Tables 2 and 3). The Importance value contributed of important value by tree was 46.34, shrubs (IV = 47.07), herbs (IV=181.47) and grass (IV = 25.12). The community preferred to grow on high percentage of sand (51%) followed by clay (43%) and silt (6%) particles. The soil of the community had lime contents (12.7%) with soil pH (6.72). The concentrations of P and K content were in the range of 3.68 and 116 mg Kg^{-1}. The community preferred EC and SOM in the range of 0.18 dS m^{-1} and 1.44%, respectively. The soil texture was found sandy clay (Table 4).

***Zizyphus- Cenchrus- Saccharum* community (ZCS)**

This community was developed at Gandiri Khattak and composed of 17 species. There were 1 tree, 3 shrubs, 11 herb and 2 grass species. Dominant plant species on the basis of important values were *Z. mauritiana* (IV = 81.8) in tree strata, *C. biflorus* (IV = 39.2) in herbaceous strata and *S. bengalense* (IV = 36) in shrubby strata. The Importance value contributed by tree was 81.9, shrubs (IV =49.98), herbs (IV = 136.5) and grass (IV = 31.62) (Tables 2 and 3). The community preferred to grow on high percentage of sand (67%) followed by clay (30%) and silt (3%) particles. The soil of the community had lime contents (12.7%), EC (0.18 dS m^{-1}) and SOM (1.29%) with soil pH (6.97). The concentrations of P and K content were initiated in the range of 3.64 and 117 mg Kg^{-1}, respectively. The soil texture was found to be sandy clay loam (Table 4).

***Calligonum*- *Tribulus*- Zizyphus community (CTZ)**

Calligonum-Tribulus-Zizyphus community established at Kiri Dhand was composed of 19 species. There were 3 tree, 5 shrubs, 9 herb and 2 grass species. The Importance value contributed by three dominants species that is, *C. polygonoides, T. terrestris* and *Z. mauritiana* was 82.78 while total importance value of 217.22 was provided by the remaining species. The contribution by tree was 25.82, shrubs (IV = 65.45), herbs (IV = 159.88) and grass (IV = 48.83) (Tables 2 and 3). The community preferred to grow on high percentage of sand (45%) followed by clay (28%) and silt (27%) particles. The soil of the community had lime contents (12.6%) with soil pH

(6.43). The concentrations of P and K content were initiated in the range of 3.79 and 120 mg Kg^{-1}. The community preferred EC and SOM in the range of 0.19 dS m^{-1} and 1.33% respectively. The soil texture was found clay loam (Table 4).

Calligonum-Cenchrus-Zizyphus community (CCZ)

Calligonum-Cenchrus-Zizyphus community at 500 m was composed of 21 species in Zarin Kala. There were 3 tree, 4 shrubs, 12 herb and 2 grass species. Dominant plant species on the basis of important values were *Calligonum polygonoides* (IV = 42.5), *Cenchrus biflorus* (IV = 30.2) and *Zizyphus mauritiana* (IV = 20.5). The Importance value contributed by tree was 32.61, shrubs (IV = 70.55), herbs (IV = 165.04) and grass (IV=31.8) (Tables 2 and 3). The community preferred to grow on high percentage of sand (62%) followed by clay (34%) and silt (4%) particles. The soil of the community had lime contents (12.6%) and SOM (1.25%) with soil pH (6.83). The concentrations of P and K content were initiated in the range of 3.81 and 123 mg Kg^{-1}. The community preferred EC in the range of 0.16 dS m^{-1}. The soil texture was found sandy clay loam (Table 4).

Zizyphus- Cenchrus- Saccharum community (ZCS)

ZCS community was established at Mona Khel and dominated by *Z. mauritiana* (IV=58.6) in tree stratum, *C. biflorus* (IV = 37.5) in herbaceous stratum and *S. bengalense* (IV = 24.6) in shrubby stratum. Other important plant species with respect to importance values were *Euphorbia helioscopia* (IV = 30.5), *E. poaeoides* (IV = 22.7) and *Calligonum polygonoides* (IV = 13.5). A total of 17 plant species in the site composed of 3 tree, 4 shrubs and 10 were included in herbaceous stratum. The Importance value contributed by tree was 71.56, shrubs (IV = 48.95), herbs (IV=156.81) and grass (IV = 22.66) (Tables 2 and 3). The community preferred to grow on high percentage of sand (63%) followed by clay (32%) and silt (5%) particles. The soil of the community had lime contents (12.7%) and SOM (1.26%) with soil pH (6.19). The concentrations of P and K content were originated in the range of 3.67 and 125 mg Kg^{-1}. The community preferred EC in the range of 0.19 dS m^{-1}. The soil texture was found sandy clay loam (Table 4).

Saccharum-Zizyphus-Cynodon community (SZC)

Saccharum-Zizyphus-Cynodon community at Jarasi was composed of 19 species. There were 3 tree, 4 shrubs, 10 herb and 2 grass species. The Importance value contributed by three dominants species that is, *Saccharum bengalense, Z. mauritiana* and *Cynodon dactylon* was 88.79 while total importance value of 211.21 was provided by the remaining species. The contribution by tree was 41.69, shrubs (IV = 55.88), herbs (IV = 140.96) and grasses (IV = 61.46) (Tables 2 and 3). The community preferred to grow on high percentage of sand (42%) followed by silt (33%) and clay (25%) particles. The soil of the community had lime contents (12.7%) and SOM (1.2%) with soil pH (6.06). The concentrations of P and K contents were originated in the range of 3.84 and 127 mg Kg^{-1}. The community preferred EC in the range of 0.17 dS m^{-1}. The soil texture was found sandy clay loam (Table 4).

DISCUSSION

The investigated area comprised 32 species in the 11 communities during summer in plains. The environmental factors, habitat, and different vegetation determined the structure of the communities. Plant communities are useful in classification, naming, and identification of vegetation structure. Muller-Dumbois and Ellenberg (1974) stated that plant community structure interpret and analyze the vegetation at diverse revelation and offer immediate information regarding vegetation and are origin for deduction of future alteration. Brinkmann et al. (2009) evaluated the vegetation reaction to ecological situation of open woodlands along an altitudinal and animal palatability preference. The factors which influenced vegetation structure are unplanted settlements, overgrazing, erosion, land sliding, habitat destruction, poverty and anthropogenic activities. In plains, during summer, 11 plant communities were identified at various parts of the investigated area at different altitudes. In summer, the plant numbers were limited due to unavailability of water and high temperature. The diverse plant communities documented in different seasons reflected different vegetation remains as recognized by Khan (2012).

Cluster analysis and species area curve shows that the vegetation is dispersed in the area (Figures 2, 3 and 4). Cluster analysis on the basis of species important value and soil also segregates the species and community of similar character into major groups of vegetation. In the present study, 5 groups were structured. From this, it was noticed that the chaining percentage would be high with high quantity and presence of species in an area. In plains, species were mostly found in all sites in less or high quantity while species presence is restricted to specific area due to diverse factors. Most factors that occur in investigated area were high grazing, cutting, non availability of water, soil erosion and uprooting of plant species. Khan and Hussain (2013a) analyzed natural vegetation of during summer and classify the vegetation into plant communities. Major group is the objective to give structure to vegetation. However, cluster analysis is a helpful preliminary position for competent judgment and

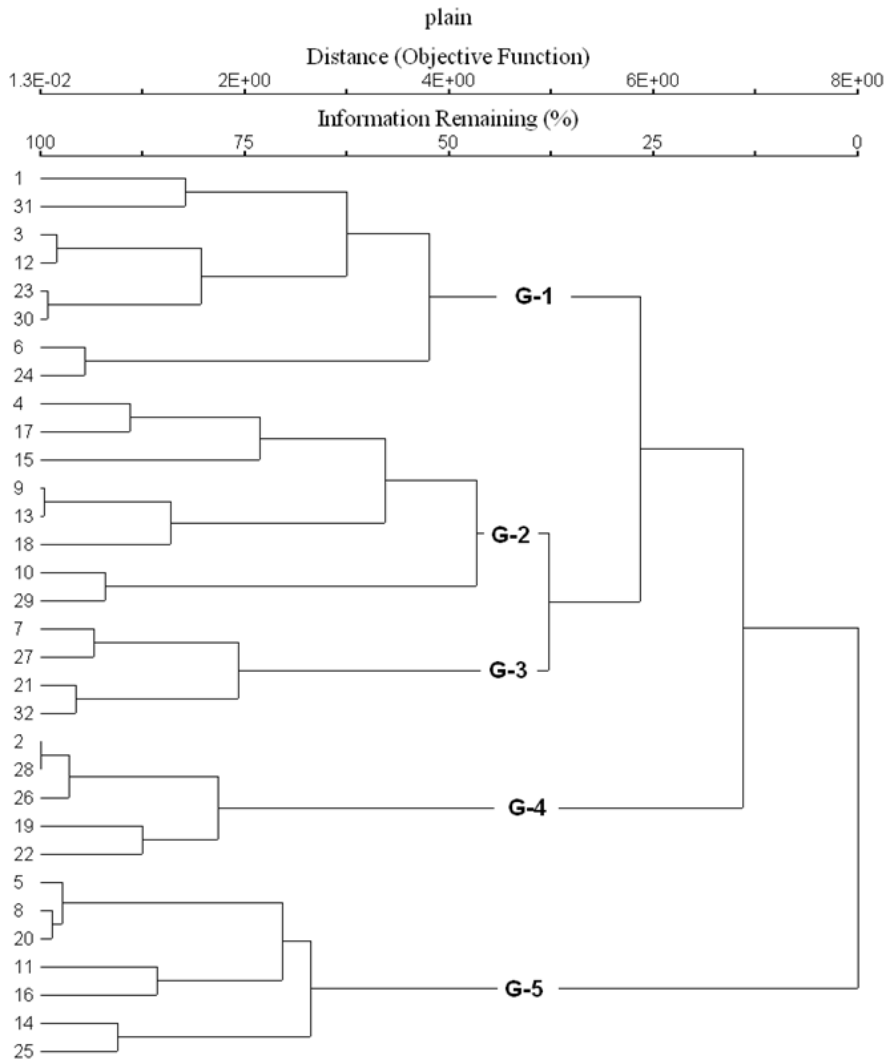

Figure 2. Two way cluster dendrogram showing grouping of different species.

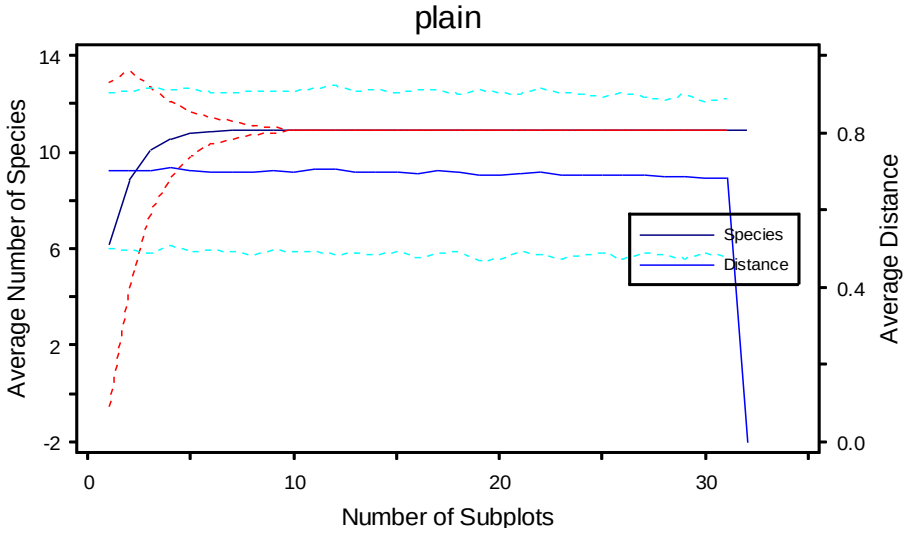

Figure 3. Species area curve showing species change with distance.

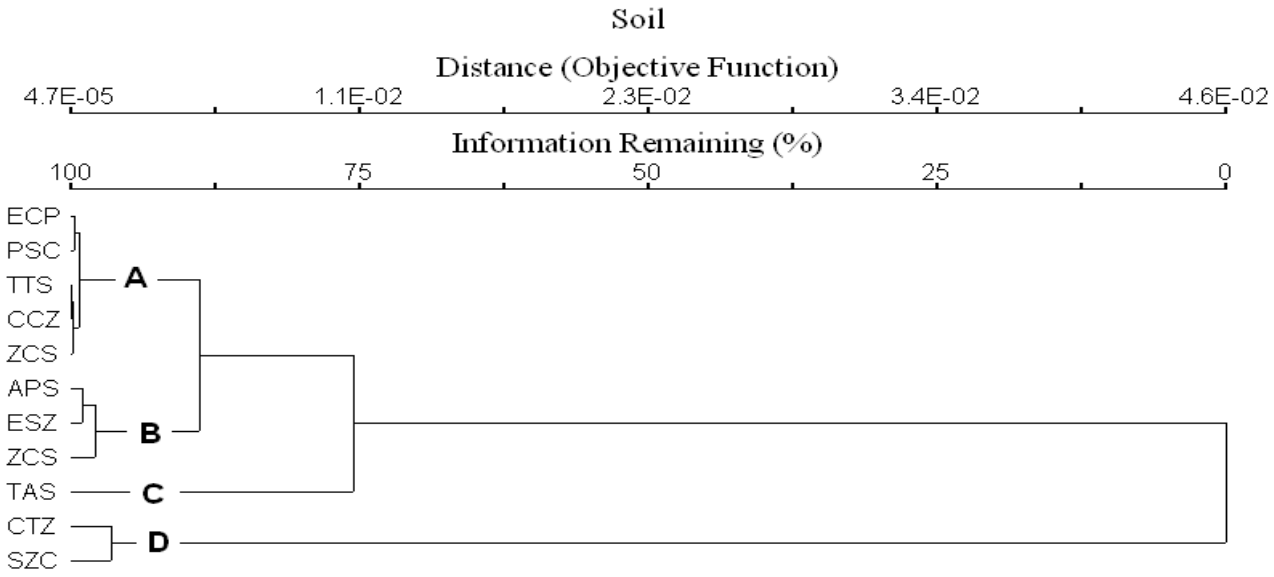

Figure 4. Two way cluster dendrogram showing grouping of different community.

Figure 5. *Calligonum polygonoides* L. vegetation in plains.

adjoining neighbors of vegetation. The greater the homogeneity within species, the greater will be the similarity in the clustering. The cluster analysis was used to give clear picture of the vegetation in an area in the form of tree - shape. In hierarchical clustering, the principle is to structure a hierarchical chain of species' groups sorting from groups of species position at the bottom to a comprehensive group at the top. The graphically diagram which represents the hierarchy in the structure of upturned tree expresses a dendogram that clarifies the arrangement in which position were united (bottom-up outlook) or group were divide (top-down outlook).

Soil is essential for continuing life on earth. Vegetation changes the physical and chemical properties of soil. It improves the soil penetration, structure and prevents erosion. According to Turner et al. (2004) and Shameem et al. (2011) the distinctive habitation is altered due to increasing human transportation and population. Other progression results into increased expected attack of organism happening all over the world. Khan et al. (2012b) and Khan and Hussain (2013b) described that the resources of soil is limited and its physical and chemical properties are restricted mostly by humus and clay. The investigated area presents a limited number of animal and plant species (Figures 5 and 6). Plant growth somewhat indirectly manipulated through soil structure. It

Figure 6. View of Ahmad Abad area.

also affects the seedling growth which is very sensitive to physical condition of soil texture. The rigid compacted layer slows down the growth of the seedling for root cannot penetrate easily in such soil.

Conclusion

The initial objective of this paper was to improve our understanding of the relationships between vegetation community structure and spectral reflectance in semi-arid environments. Although variations in the relative proportions of herb, shrubs and trees cover are likely to change the composite reflectance, it is clear that the relationship between vegetation community structure and reflectance is ambiguous; the effect of inter-canopy shadowing by herb canopies is indistinguishable from the more general effect of reduced reflectance due to increased vegetation cover. Therefore, the relationship cannot be inverted and used to estimate variations in vegetation structure. Grazing practices need to be limited and monitored along with creating the awareness among the native about conservation and sustainable management of grasslands. Fenced vegetation plots should be designed at regular intervals to act as seed banks in whole area. Grazing practices should be synchronized with plant growth seasons so that damage to vegetation during flowering stage can be avoided.

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