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Phytosociological Attributes of Different Plant Communities of Pir Chinasi Hills of Azad Jammu and Kashmir

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ABSTRACT

The vegetation of Pir Chinasi hills has been protected from biotic interference and can be used as a typical example of natural vegetation showing vigorous growth. Environmental factor such as climate, soil condition, temperature, humidity, rain fall, wind and biotic factor were studied in relation to vegetation structure. The soil varied from heavy loam to clay and clay loam with pH of 5.4-7.0, electrical conductivity varied from 0.02-1.48 dS m^{-1}, Phosphorus 5-25 ppm, potassium100-500 ppm, 3.3-6.7% organic matter and 40-80% saturation. On the whole13 plant communities were recognized and a total of 77 species were recorded. It was found that chemical contents of soil played a significant role in giving particular shape to these communities.

Key Words: Soil structure; Temperate vegetation; Climatic conditions; Azad Jammu and Kashmir; Community structure

INTRODUCTION

Pir chinasi hill is situated in District Muzaffarabad and lies within latitude 34° 22' to 24' north and between longitudes 73°32' to 73°75' east (Toposheet number 11A), while altitude varies between 1600 to 3048 m. It is bounded on North by Kuna Bagnu, on South by Saran & Jabra, on the West by Sani forest and Dohda and on the East by Gal and Ghuriala forest. The rocks ranged from Quartz micaschist, granet quartz micaschist, graphitic phyllite, garnet myllonite, low grade quartzite to granite gneiss (Greco, 1986). The climate ranges from very pleasant summer to extremely cold and lengthy winter. Maximum rainfall occurs in the months of July and August approximately 307 mm and 213 mm respectively. The maximum temperature from January to March remains about 20°C while around 6°C during winter. It decreases and remains within 13.62°C during October. At the same time the minimum temperature also drops from 8.04°C to less than 4°C in December, while the minimum temperature lies between 18.41 to 22.69°C. It decreases and remains within 13.62°C during October. At the same time the minimum temperature also drops from 8.04 °C to less than 4°C in December (Table I). The vegetation of Pir chinasi hills was studied in spring 2004, to report its recent picture, correlate vegetation with its edaphic and climatic conditions and to suggest possible ecological approaches for the improvement of plant resources and socioeconomic status of the area. A lot of work has been done on vegetation aspects. e.g., by Papanastasis *et al.* (2000); Miller *et al.* (2000); Kikim and Yadava (2001); Dickore and Nusser (2000); Karabulutum (2003); Deniz and Sumbul (2004); Parolly (2004); Kharkwal *et al.* (2005); Singh *et* a*l.* (2005); Fakir (2006) and Henrik *et al.* (2006). In Pakistan following studies were done on different aspects of vegetation (Marwat *et al.*, 1990; Tareen & Qadir, 1993; Dasti & Malik, 2000; Malik *et al.*, 2000). Similarly in Azad Jammu and Kashmir, Malik *et al*. (1990, 1994, 2001); Malik and Malik (2004) and Malik 2005 have reported vegetation of different parts. Some work has been done on the vegetation of Pir chinasi hills by Ashraf (1995), who reported that in this area *Picea, Abies* & *Juglans* were not regenerated as depicted by age classes. The purpose of the study was to analyze and interpret the plant communities on different exposure, and to gather first hand information about the vegetation of this unexplored and floristically rich area.

MATERIALS AND METHODS

The investigated area is divided into thirteen stands on the basis of altitude, physiognomy, aspect, degradation stage. Based on species area curve, the suitable size of the quadrat for trees, shrubs and herbs were determined which were 10 x 2 m, 5 x 2 m and 0.5 m. The exact dimension of one community was 100 m square. Similarly, the suitable numbers of quadrats in each stands were 5, 10 and 15 (Malik *et al*., 2001). Density, frequency and canopy cover of each species were recorded and converted to their relative scale following the methods of Curtis and Mc-Intosh (1951) and Stephenson (1986). Plant communities were recognized on the basis of highest importance values of species and were named after the leading dominants, following the methods of Malik (2001). Nomenclature followed here is those of Stewart (1972), Nasir and Ali (1994); Ali and Qaisar (1995-2004).Soil samples from each stand were collected up to the depth of 15 cm and were analyses physically and chemically in the soil-testing laboratory of NARC, Islamabad. Soil were analyzed as a single sample (Table III).

RESULTS

***Ficus-Lepidium-Chenopodium* community**. At 1600 m height, this community was present. Of the 16 recorded species; there were three tree, four shrubs, seven herbs and two grasses. The total importance value (TIV) contributed by 3 dominants was 90.75 while that of 209.06 was provided by the remaining species. The contribution by tree was 65.29, shrubs 52.94, herbs 145.52 and grasses 36.06 (Table II). Soil in this community was heavy-loam with acidic pH (6.8). The percentage of organic matter (OM) was 4.9%, phosphorus (P) 14 ppm, potassium (K) 500 ppm and electrical conductivity (EC) 0.3 dS m^{-1} (Table III).

***Cynodon-Sida-Berberis* community.** This community at 1750 m height was composed of 18 species (Table II). There were four tree, four shrub, nine herb and one grass species. The total importance value contributed by three dominant was 70.73. The remaining species shared a TIV of 228.95. The contribution by tree was 34.52, shrubs 77.33, herbs 161.79 and grasses 26.04. Soil in this community was heavy loam with pH 7.0. The P and K contents of this soil were 10 ppm and 360 ppm respectively and EC of 0.16 dS m^{-1} (Table III).

***Pinus-Themeda-Berberis* community.** This community was present at 1800 m height (Table II). There were four trees, five shrubs, nine herbs and two grasses. The total importance value contributed by three dominant was 80.97. The remaining species contributed 218.75. The contribution toward TIV by tree was 81.87, shrubs 58.77, herbs 114.70 and grasses 44.38%. Soil in this community was clay-loam with pH 5.3. The P and K content of soil were 7.5 ppm and 100 ppm respectively and EC 0.11 dS m^{-1}.

***Pinus-Indigofera–Brunella* community.** At 1900 m height, this community existed which included one tree, four shrubs, none herbs and three grass species. A TIV of 88.27 and 211.52 was recorded for dominants and other species respectively. The contribution by tree was 41.65, shrubs 69.85, herbs 157.90 and by grass species 30.39 (Table II). Soil in this community was heavy loam with 5.6 pH, OM 4.9%, saturation percentage 45, P 5 ppm, K 360 ppm and EC 0.10 dS m^{-1} (Table III).

***Ficus-Veronica-Verbascum* community.** This community was established at 2050 m height. It consisted of three trees, four shrub, nine herbs and one grass species. Total importance value contributed by 3 dominant was 78.79 and 220.98 by remaining species. The contribution by the trees was 63.85, shrubs 58.29, herbs 158.76 and 18.87 by grasses (Table II). Soil in this community was recorded as loam with pH 6.8.The K content was 140 ppm while OM content was 4.9% and EC was 0.03 dS m^{-1} (Table III).

***Veronica-Pinus-Oenothera* community.** At 2200 m height, this community comprised 16 species. There were one tree, five shrubs, nine herbs and one fern. Three dominants and the remaining species had TIV of 76.65 and 223.07 each. The contribution by tree was 26.12, shrubs 79.88, herbs 179.76 and pteridophyte 13.96 (Table II). The soil in this stand was clay-loam with pH 6.0. The percentage of organic matter was 6.6% while the contents of P and K were 10 ppm and 240 ppm respectively and EC was 0.07 dS m^{-1} (Table III).

***Indigofera-Ranunculus-Veronica* community.** At 2350 m height, This community consisted of one tree, four shrubs, 11 herbs and one grass species (Table II). The TIV contributed by three dominants was 78.11, while it was 221.61 by others. The contribution by tree was 20.64, shrubs 84.57, herbs 176.89 and grasses 17.62. Soil in this community was clay-loam with pH 5.8. The OM was high (6.4%) whereas P and K content was10 and 200 ppm respectively (Table III).

***Pinus-Viburnum-Poa* community.** This community at 2500 m height comprised 14 species (Table II). There were one tree, three shrubs, eight herbs, one grass and one fern. The TIV by three dominants was 103.26, and 196.57 by others. The contribution by tree was 50, shrubs 63.06 herbs 148.13, grasses 26.61 and fern 12.03. The clay loamy soil of this community had pH 5.4, OM 3.4% and 100 ppm P and K respectively, and EC 0.13 dS m^{-1} (Table III).

***Pinus-Viburnum-Fragaria* community.** At 2650 m height, This community comprised one tree, three shrubs, nine herbs one grass and one fern. The TIV contributed by three dominants was 107.87, while 191.90 by others (Table II).

Table I. Meterological Data of Muzaffarabad, Azad Jammu and Kashmir (1996-2005)

Months	Temperature (°C)		Rainfall (mm)	Humidity (%)	
	Mean Maximum	Mean Minimum	Mean total	8.00A.M	5.00P.M
January	17	3.21	100.34	82	51
February	18.61	5.44	140.03	81	45
March	23.73	10.15	129.72	68	38
April	29.45	14.92	91.13	58	35
May	34.32	18.41	73.15	59	32
June	36.82	20.10	125.61	62	37
July	35.35	23.14	307.22	79	51
August	34.12	22.69	213.19	83	55
September	33.76	20.06	120.00	74	48
October	30.35	13.62	45.58	77	43
November	24.65	8.04	33.81	82	47
December	19.23	3.93	27.66	84	54

Courtesy: Pakistan Metrological Department, Lahore.

Table II. Phytosociological attributes of different plant communities recorded at Pir-Chinasi hills during spring

Name of Species	Maximum I.V	Minimum I.V	Average I.V	No. of Stands Present
Abies pindrow Royle	17.53	17.53	1.34	1
Acacia arabica (Lam) Willd	19.31	18.52	2.91	2
Aesculus Indica L (Wall ex camb)	6.25	6.25	0.48	1
Androsace rotundifolia Hard	32.02	32.02	2.46	1
Arisaema Jacquemontii Blume	53.62	28.44	6.31	2
Aster alpinus (Clarke) Hutch	17	17	1.3	1
Berberis lycium Royle	22.13	10.91	8.73	7
Bergenia ligulata Auct	16.03	14.39	2.34	2
Bromus japonicus Thunb ex Murr	26.76	26.76	2.05	1
Brunella vulgaris L.	21.88	9.12	5.38	4
Calamintha umbrosa (M.Bieb) Fisch & Mey	13.97	13.97	1.07	1
Caltha palustris L.	22.56	16.11	7.42	5
Centaurea iberica Trevir ex Sprengel	19.82	15.59	4.19	3
Chenopodium album L.	22.59	16.82	3.03	2
Chrysopogon aucheri (Boiss) Stapf	14.34	14.34	1.1	1
Conyza canadensis L.	19.7	19.7	1.51	1
Cynodon dactylon (L.) Pers	26.04	16.24	7.63	5
Cynoglossum lanceolatum Forssk	12.49	9.22	2.56	3
Delphinium roylei Munz	21.05	21.05	1.61	1
Diclyptera roxburghiana Nees	13.87	13.87	1.06	1
Diospyros lotus L.	8.00	6.06	1.08	2
Dryopteris stewartii Fress	13.96	13.96	1.07	1
Elymus repens (L.) Gould	21.85	16.32	2.93	2
Euphorbia helioscopia L.	11.55	11.55	0.88	1
Euphorbia wallichii H.K.F.	26.43	13.82	7.06	5
Ficus palmata Forssk	38.77	13.92	6.81	3
Fragaria nubicola Lindl	28.78	13.32	13.91	9
Geranium nepalense Sweet	15.94	15.94	1.22	1
Geranium rotundifolium L.	15.91	12.87	2.21	2
Geum elatum Wallich	18.77	15.83	2.66	2
Hypericum perforatum L.	21.76	15.57	5.82	4
Impatiens edgeworthii H.K.F.	17.18	10.11	2.09	2
Indigofera heterantha Wall ex Brandis	24.74	13.39	13.27	9
Juglans regia L.	17.02	17.02	1.03	1
Leontopodium alpinum Cass	18.25	18.25	1.4	1
Lepidium sativum L.	29.39	15.33	4.69	3
Malva parviflora L.	13.06	13.06	1	1
*Micromeria biflora (*Ham) Bth	21.53	10.29	2.44	2
Morus nigra L	14.34	8.65	1.76	2
Oenothera rosea (L.) Her	22.29	12.1	7.08	5
Onychium japonicum (Kunze) Wallich	17	12.03	3.26	3
Oxalis corniculata L.	9.02	9.02	0.69	1
Parrotiopsis Jacquenmontiana Dc Rehder	18.53	15.23	3.79	3
Picea Smithiana (Wallich) Boiss	54.2	54.2	4.16	1
Pinus roxburghii Sargent	17.41	17.41	1.33	1
Pinus wallichiana A.B. Jackson	55.11	20.64	28.98	9
Plantago lanceolata L.	25.5	11.55	4.68	3
Poa alpina L.	17.62	17.62	1.35	1
Poa bacteriana Rozhev	26.61	13.45	4.24	3
Potentilla eriocarpa Wall ex Lehm	38.2	31.74	5.38	2
Primula denticulata Smith	48.45	48.45	3.72	1
Pyrus pashia Buch	15.36	7.87	1.78	2
Ranunculus laetus Wall	25.12	16.1	3.17	2
Ranunculus repens L.	7.79	7.79	0.59	1
Rosa macrophylla Lindley	19.28	11.11	6.01	5
Rosa webbiana Wallich ex Royle	8.19	8.19	0.63	1
Rubus fruticosus L	18.03	7.06	2.74	3
Rumex hastatus D.Don	12.84	12.84	0.96	1
Rumex nepalense Sprenge	24.6	24.6	1.89	1
Senecio chrysanthemoides DC	21.31	21.31	1.63	1
Setaria pumila (Poir.) Roem and Schult.	21.85	14.15	4.38	3
Solanum nigrum L.	18.04	18.04	1.38	1
Solanum xanthocarpum Schrad & wendle	20.07	20.07	1.54	1
Sonchus asper Hill	18.78	11.56	2.33	2
Sorbaria tomentosa (Lindley) Rehder	16.13	16	2.47	2
Taraxacum officinales Weber	22.49	22.49	1.73	1

Table II. Cont.

Themeda anathera Nees ex Steud	28.06	28.06	2.15	1
Thymus serphyllum Auct.	48.78	12.8	9.02	4
Trifolium repens L.	47.72	9.61	10.92	7
Trisetaria loeflingiana L.	14.98	14.98	1.15	1
Verbascum thapsus L.	20.56	18.99	3.04	2
Veronica melissaefolia DC	32.11	9.53	13.24	9
Viburnum grandiflorum Wall ex DC	34.92	10.57	14.7	9
Viola odorata L.	17.28	8.76	3.93	4
Zanthoxylum armatum DC	12.88	3.59	1.26	2

Table III. Physico-Chemical analysis of the communities recorded from Pir-Chinasi Hills

Altitude(m)	Soil texture	pH	EC ds/m	P ppm	K ppm	O.M (%)	Saturation (%)
1600-2050m	Heavy loam to loam	6.8	0.1-0.3	14-15	500-140	4.9	45-40
1750-1900m	Heavy loam to clay loam	7-5.6	0.10-0.16	5-Oct	360-100	6.0-4.1	45
2200-2350m	Heavy loam	5.8-6	0.07-0.22	10	240-200	6.6-6.4	50-45
2500-2800m	Heavy loam to clay and clay loam	6.4	0.13-1.48	25-10	100-160	6.7-3.3	45-80
2925-3000m	Heavy loam to loam	5.4-5.6	0.2-0.97	12-2.5	100	6.6-3.8	45-40

The contribution toward total importance value by tree was 45.75, shrubs 59.98, herbs 167.23, fern 13.36 and grasses 13.45. The soil was clay with pH 3.5. In this community the K (100 ppm) contents were low while P (15 ppm), OM 3.3% high. The EC was 0.13 dS m^{-1} (Table III).

***Pinus-Picea-Bromus* community.** At 2700 m height, This community was composed of two trees, two shrubs and 10 herbs. The TIV contributed by three dominant was 136.07 and by the remaining species 163.69. The contribution toward total importance value by tree was 113.22, shrubs 34.41 and herbs 152.13 (Table II). The soil in this community was clay-loam with pH 5.4. Pottasium and P contents were 160 ppm and 2.5 ppm respectively. The OM was high with 45% saturation and EC 0.18 dS m^{-1} (Table III).

***Pinus-Viburnum-Plantago* community.** At 2800 m height, this community existed with two trees, two shrubs and 11 herbs. The TIV contributed by three dominant species was 100.54. The contribution by herbs alone was 199.27 (Table II). The soil in this community was clay –loam with pH 6.4. The OM (6.75%) was very high in whereas the P and K were 15 ppm 140 ppm respectively, and EC was 1.48 dS m^{-1} (Table III).

***Pinus-Potentilla-Thymus* community.** This community, at 2925 m height, comprised 10 species, (Table II). There were one tree, one shrub, seven herbs and one grass species. The TIV contributed by 3 dominant species was 126.78, and 173.11 by others. The soil in this community was heavy-loam with OM 6.6%, pH 5.4, K 100 ppm, P 12 ppm and EC 0.02 dS m^{-1} (Table III).

***Anaphalis-Thymus-Primula* community.** At 3000 m height, this community existed with one shrub and nine herbs. The TIV contributed by three dominant species was 150.85. The contribution by herbs alone was 149.01 (Table II). The contribution of shrubs toward TIV was 10.57 and herbs contributed 289.29. The soil in this community was loamy with pH 5.6. K and P w as 100 ppm and 2.5 ppm, respectively. The OM was 3.8%, saturation was 40% and EC 0.97 dS m^{-1} (Table III).

DISCUSSION

Structure of Communities is the outcome of the habitat, environmental conditions and existing vegetation types. Community structure provides data about recognition and definition of different vegetation types; their mapping and the study of relationship between plant species distribution and environmental control. Community structures analyze and interpret the plants at different exposures and provide first hand information about the vegetation and basis for prediction of likely future changes (Mueller Dum-bois & Ellenberg, 1974). Since soil and biotic factors are related to each other, change in anyone of these components might cause a change in other associated components.

Human interaction moulds the shape and course of succession of a community (Grubb, 1987). Amongst major factors that influenced vegetation structure are human disturbance, extensive grazing, trampling and soil erosion. The present study area lied between 1600 and 3000 m high from sea level. There were thirteen plant communities in spring seasons. The vegetation of the investigated area was divided into four zones according to Champion *et al.* (1965); which are Siwalik moist Chir pine forest, Low-level blue pine forest, Moist temperate forest and Sub-alpine forest. Time of sampling and seasonal activities changes the shape of the communities (Malik, 2005).In the investigated area, the woody and perennial species almost remained the same while the composition of community changed due to the predominance of annuals (Therophytes) during spring, which showed seasonal effect. The communities established in present study actually reflected various remnants; degraded stages of major vegetational unit as identified by Champion *et al.* (1965), Beg (1984) and Malik (2005). It appeared that *Ficus-Lepedium-Chenopodium* community

might be the remnant of the original temperate forest. The associated woody species were *Acacia arbica, Diospyrus lotus, Aesculus indica, Morus nigra, Pyrus pashia, Berberis lycium, Indigofera heterantha, Rubus niveus and Zanthoxylum armatum*, while the perennial grasses were *Chrysopogon aucheri, Cynodon dactylon, and Setaria pumila* (Table II). These plants are characteristic of temperate zone. This vegetation then shifted to *Pinus-Indigofera-Brunella and Pinus-Themeda-Berberis and Cynodon-Sida-Berberis* (altitude 1700–1900 m). The local inhabitants use *Pinus wallichiana* for different utilities which caused the degradation of woody species with hampered regeneration. The habitat condition got modified with the removal of vegetation cover. Soil moisture and litter was higher under *Pinus-Themeda-Berberis* community, here soil was clay-loam with high amount of organic matter. While in the degraded sites, besides soil moisture, organic matter also reduced (Table III). Therefore, species manifested the indication of requiring low fertility and less moisture. The change of dominance from *Pinus* to *Cynodon* as seen in *Cynodon-Sida-Berberis*, might be due to low fertility especially (low P) and soil moisture (Table III). The habitat had deteriorated due to increased degradation. *Indigofera* and *Pinus* appear as dominant species in such sites. Here the habitat condition was apparently drier and less fertile as compared to previous site. The community therefore shifted to *Pinus-Indigofera-Brunella. Indigofera* is a leguminous and less-palatable plant. It is utilized as a fuel species. The removal of *Pinus Wallichiana* and *Ficus palmata* from 1600-1900 m helped niche to form grassland community, which was characterized by *Cynodon-Sida-Berberis* and *Pinus- Heteropogon-Indigofera* community. Many workers have described similar degraded vegetation in different parts of Azad Jammu and Kashmir and Pakistan (Malik, 2005, Hussain *et al.* 1992; Hussain and Ilahi, 1991). Moreover, Haridasan *et al.* (1993) Sakya and Bania (1998) in Northwest. Himalayas in Arhunchal pradash India reported a similar situation. Altitude is an important factor for the determination of the vegetation type. The change in altitude is readily reflected by change in floristic composition and community setup (Sakya & Bania, 1998). Vegetation composition became patchier at open-canopy (Dolezal & Srutek, 2002). With increased in altitude from 2000-2600 m *Pinus-Cynodon-Dichanthium, Veronica-Pinus-Oenothera,* Pinus-Viburnum-Poa, *Pinus- Fragaria-Indigofera, Pinus-Indigofera-Onychium* communities became dominant. *Pinus, Viburnum, Rosa, Berberis, Desmodium*, were the original components of the Sub-alpine forest in Pir-Chinasi hills. The degradation of habitat further modified the vegetation type. From 2700-2800 m *Pinus-Picea-Bromus, Pinus-Viburnum-Plantago* communities were dominant. *Pinus, Picea, and Viburnum* were the original components of alpine forest. The soil under these communities was clayloam to heavyloam with acidic pH, P 2.5-15 ppm and K 140-160 ppm, while organic matter was high (Table III). With further increased in height grasses and herbs became dominent from 2900-3000 m (Table II).

Here following communities were present: *Pinus-Potentilla-Thymus, Anaphalis-Thymus-Primula*. Trampling, human disturbances, nomad deforestation, extensive grazing disturbed the vegetation to a great extent, which might be the cause of the removal of trees and shrubby vegetation. Human disturbance, extensive grazing resulted in the formation of highly fragmented vegetation type, which had important impact on community structure (Cierjack & Hensen 2003). *Poa* and *Arisaema* were Dominant in the top of Pir-Chinasi hills due to grazing & sever deforestation.

CONCLUSIONS

There is an urgent need to promote ethics that conservation and improvement of natural vegetation is critical for soil and land management. Soil is being eroded very rapidly due to low vegetation cover. Cold climate with heavy snowfall, high wind velocity, low temperature, rainfall and variation in altitude influence the vegetational pattern. The vegetation is of open type due to deforestation. Deforestation, overgrazing, soil erosion, uprooting of medicinal plants were main causes of removal of vegetation. The area need complete protection for at least 10 years, so that original vegetation could exist again.

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