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Floristic composition and vegetation structure of subtropical pine forest of district Buner, Khyber-Pakhtunkhwa, Pakistan

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Abstract

Deforestation, over-grazing and soil erosion influences vegetation structure of an area. The present study was carried out at District Buner during March, 2012 with the objectives to evaluate the phytosociology of the area. Four stands were selected intentionally and four communities were established on the basis of importance value. The communities were *Diplachne-Olea-Cynodon* community, *Cynodon-Dodonaea-Ailanthus* community, *Rubus-Cymbopogon-Ailanthus* community, *Justicia-Cymbopogon-Ailanthus* community. A total of 87 plant species have been recognized belonging to 53 families among which 3 species belonging to 3 families of pteridophytes and 8 species belonging to 4 families of monocots. Gymnosperms were represented by a single family Pinaceae with single species *Pinus roxburghii* while the rest of 75 species distributed among 45 dicots families. Among the families Papilionaceae was observed to be the most diverse. Life form and leaf spectra were also determined.

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Introduction

Vegetation is the expression of ecological conditions of plants and other resources and also the habitat which tend to formulate the community structure of an area. Different vegetation types can be recognized and defined on the basis of community structure. Several studies have been done on the vegetation of various parts of Khyber Pakhtunkhwa recently (Tareen and Qadir, 2000; Malik and Hussain, 2006; Hussain *et al.,* 2006; Sher and Khan, 2007; Ahmad *et al.,* 2008; Qureshi & Bhatti, 2008 and Parveen *et al.,* 2008).

The floristic composition and its ecological characteristics such as life form and leaf spectra were also evaluated. Life form and leaf size spectra reflect climatic and human disturbance of a particular area (Cain and Castro, 1959). In Pakistan following studies were done on the vegetation (Qadir and Tareen 1987; Tareen and Qadir, 1993; Badshah *et al.* 1996; Wali, 1966).

Wahab *et al.* (2008) reported phytosociology of some pine forests of Afghanistan, situated near the Pakistani border. Sher and Khan (2007) studied the floristic composition, life form and leaf spectra of District Buner.

However, further phytosociological exploration of the area is needed. The present study is therefore undertaken to collect first hand information about the vegetation of District Buner, which is unexplored and floristically rich area and to establish plant communities on different sites. The findings might be helpful to ecologists, ethnobotanists and conservationists.

Material and methods

Study area description

District Buner lies between 34°-11 to 34°- 43 N and 72°- 13 to 72°- 45 E. It has a total area of 1,865 SqKm.

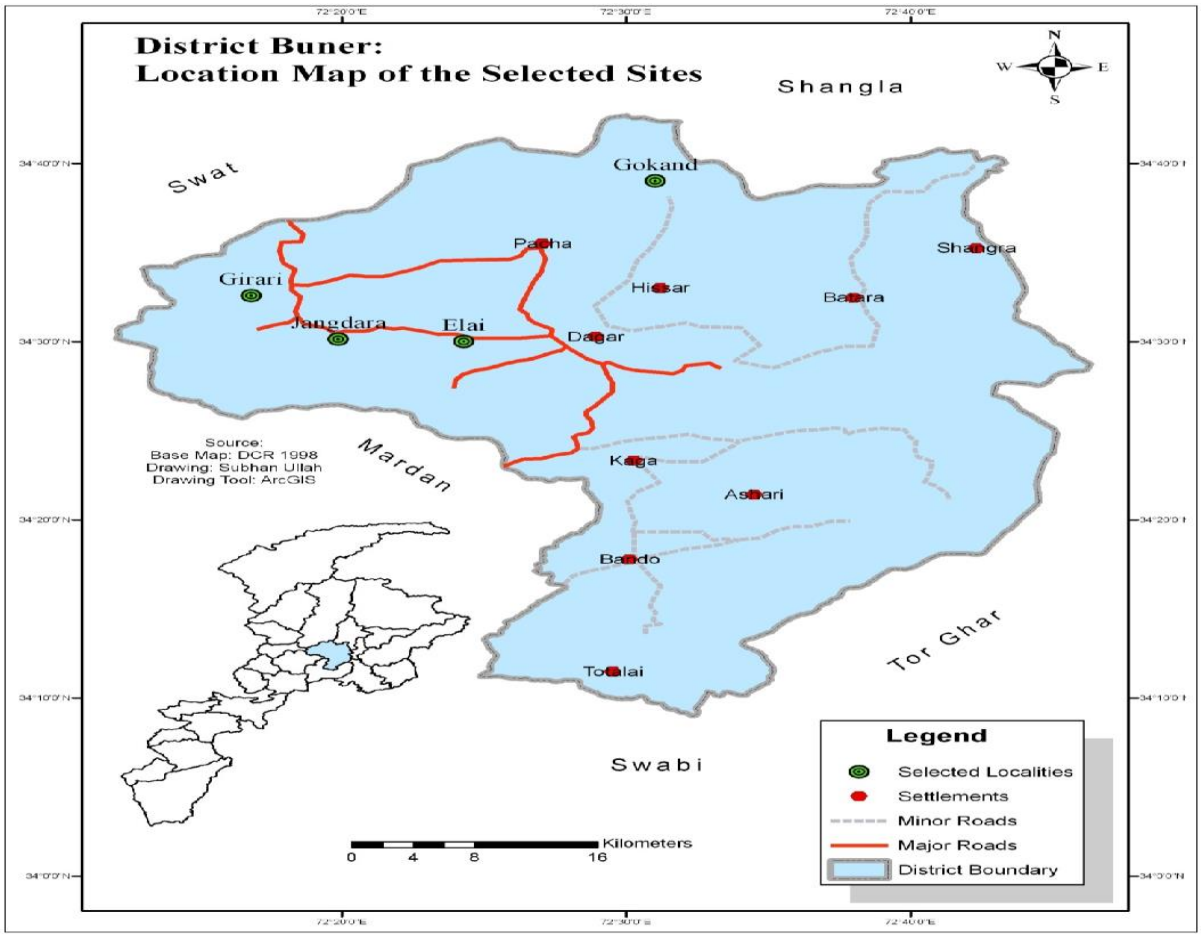

Fig. 1. Location map of the study area of District Buner.

It is bordered on the north by Swat and Shangla districts, on the west by Malakand agency and Mardan district, on the south by Swabi district and on the east by river Indus, Haripur and Mansehra districts. The altitude gradually rises from 366m in south Totalai to 2,911m in the north Dosra Peak (Sher and Khan, 2007). Climatically, the area can be sorted as dry sub-tropical. Winter season is short and moderate which extends from November to February. Mostly the winter season is pleasant or partially cold. Snowfall may occur occasionally on the mountains. Summer season lasts for 7-8 months with hot in lower parts of Buner and pleasant in the upper parts. During summer the area receives monsoon rains from mid-April till August. During summer a steady rise in temperature is observed that reaches the maximum, 44°C and thereafter drops gradually to the lowest 2°C in winter. The total annual rainfall is 165cm with scattered distribution.

Study design

The present study was undertaken during the last week of March, 2012. Four representative stands were selected. Trees, shrubs and herbs were sampled by using 10x10m, 5x5m and 1x1m quadrats in a nested way (Hussain, 1989).

The trees were counted by species and the circumference of each tree was determined at breast height. It was transformed to basal area following (Hussain, 1989).

Density, frequency and canopy cover/basal area thus determined were converted into relative values (relative density, relative frequency and relative canopy cover/basal area) and summed up to determine Importance Values (IV) for each strata species. Plant communities were established on the basis of highest IV for trees, shrubs and herbs.

Plants were collected, preserved and identified with available literature (Nasir and Ali, 1971-1995; Ali and Qaisar, 1971-2010). Leaf size and life forms were determined after Raunkier (1934) and Hussain (1989). Soil was taken in duplicate upto 15cm depth. It was mixed to get a composite sample for each stand.

The physical and chemical characteristics of soil samples were analyzed, using standard methods (Hussain, 1989) at Nuclear Institute for Food and Agriculture (NIFA), Peshawar.

Results

Vegetation Structure

Following four different communities were established in the study area.

Diplachne-Olea-Cynodon community

The community was located at Gokand valley at elevation ranges from 1046-1206 m and consisted of 33 species with 10 trees, 12 shrubs and 11 herbs.

Table 1. Floristic list, Life form and Leaf size classification of some plants of District Buner

Groups	Family	Plant Species	Biological spectra	
			Life form spectra	Life size spectra
Pteridophytes	Adiantceae	*Adiantum capillus-venaris* L.	G	Mic
	Athyriaceae	*Athyrium rupicula* (Edgew ex Hope) C. Chr	G	Le
	Pteridaceae	*Pteris cretica* L.	G	Mes
Gymnosperms	Pinaceae	*Pinus roxburghii* Sarg.	MP	Na
Monocots	Arecaceae	*Phoenix dactylifera* L.	MP	Mic
	Asparagaceae	*Asparagus gracilis*	G	Le
	Hyacinthaceae	*Scilla griffithii* Hochr.	G	Na
	Poaceae	*Cymbopogon jwarancusa* (Jones) Schult.	H	Mic
		Cynodon dactylon (L.) Pers.	H	Le
		Diplachne fusca (Linn.)P. Beauv. ex Roem. & Schult.	H	Mic

		Heteropogon contortus (L.) P.Beauv. ex Roem & schult.	H	Mic
		Saccharum bengalense Ritz.	H	Mic
Dicots	Acanthaceae	*Justicia adhatoda* L.	NP	Mic
		Dicliptera bupleuroides Nees	TH	Na
	Anacardiaceae	*Cotinus coggyria* Scop.	NP	Mic
		Pistacia integrima J.L.Stewart ex Brandis	MP	Na
	Apiaceae	*Scandix pectinveneris* L.	TH	Le
	Araliaceae	*Hedera helix L.*	NP	Mes
	Asteraceae	*Artimisia absinthium* L.	CH	Mic
		Lactuca serriola L.	TH	Mic
		Saussurea heteromalla (D. Don) Hand.-Mazz.	TH	Mic
		Taraxacum officinale Weber.	TH	Mic
	Berberidaceae	*Berberis lyceum* Royle.	NP	Mic
	Betulaceae	*Alnus nitida* Mill.	MP	Mic
	Bignoniaceae	*Incarvillea emodi* Royle ex Lindl.	TH	Na
	Brassicaceae	*Alliaria petiolata* (M. Bieb.) Cavara & Grande.	TH	Mes
	Buddlejacaceae	*Buddleja crispa* Benth.	NP	Mic
	Caesalpinaceae	*Bauhinia variegata* L.	MP	Mes
	Canabanaceae	*Cannabis sativa L.*	TH	Mic
	Capparidaceae	*Capparis spinosa* L.	NP	Mic
	Caryophyllaceae	*Stellaria media* (L.) Cry.	TH	Na
	Celasteraceae	*Maytenus royleanus* Wall.ex Lawson	NP	Le
	Cornaceae	*Cornus macrophylla* Wall.ex Roxb.	MP	Mes
	Euphorbiaceae	*Andrachne cordifolia* (Den) Muell.	NP	Mic
		Euphorbia helioscopia L.	TH	Na
		Mallotus phillipensis Lam.	NP	Mic
	Fagaceae	*Quercus incana* Roxb.	MP	Mic
	Lamiaceae	*Ajuga bracteosa* Wall. Benth.	TH	Mic
		Coelebrookea oppositifolia Smith	NP	Mes
		Origanum vulgare L.	CH	Mic
		Otostagia limbata Benth.	NP	Na
	Linaceae	*Reinwardtia trigyna* Roxb.	NP	Na
	Lythraceae	*Woodfordia fruticosa* (L.) Kurz	NP	Mes
	Meliacea	*Melia azedarach* L.	MP	Mic
	Mimosaceae	*Acacia modesta* Wall.	MP	Le
		Prosopis glandulosa Torr.	NP	Le
	Moraceae	*Broussonetia papyrifera* L.	MP	Mes
		Ficus carica L.	MP	Mes
		Ficus glomerata Roxb.	MP	Mes
		Ficus palmata Forssk.	MP	Mes
		Morus nigra L.	MP	Mes
		Morus serrata Roxb.	MP	Mic
	Myrsinaceae	*Myrsine africana* L.	NP	Na
	Myrtaceae	*Eucalyptus camaldulensis* Dehnh.	MP	Mes
	Oleaceae	*Olea ferruginea* Royle.	MP	Mic
	Oxalidaceae	*Oxalis corniculata* L.	TH	Mic
	Papilionaceae	*Astragalus leucocephalus* Grah. Ex Benth.	TH	Le
		Desmodium tiliafolium D. Done	NP	Na
		Indigofera heterantha L.	NP	Le
		Lathyrus sphaericus L.	TH	Na
		Medicago minima (L.) Grub.	TH	Le
		Robinia pseudoacacia L.	MP	Na
		Vicia peregrima L.	TH	Na

	Vicia sativa L.	TH		Na
Plantaginaceae	*Plantago lanceolata* L.	H		Mes
Polygonaceae	*Rumex dentatus* L.	CH		Mes
	Rumex hastatus L.	CH		Mic
Primulaceae	*Anagallis arvensis* L.	TH		Na
Punicaceae	*Punica granatum* L.	MP		Na
Ranunculaceae	*Clematis grata* Wall.	NP		Na
	Delphinium uncinatum Hook & Thomas	TH		Na
Rhamnaceae	*Sageratia thea* (Osbeck) M.C. Johnst.	NP		Le
Rosaceae	*Duchesnea indica* (Andrews) Focke	TH		Mic
	Pyrus pashia Buchanan-Hamilton ex D. Don	MP		Mic
	Rubus fruticosus Hkf None L.	NP		Mic
	Rubus ulmifolius Schott.	NP		Mic
Rutaceae	*Zanthoxylum armatum* DC.	NP		Mes
Salicaceae	*Populus alba* L.	MP		Mes
Sapindaceae	*Dodonaea viscosa* (Linn) Jacq	NP		Mic
Scrophulariaceae	*Verbascum thapsus* L.	TH		Mes
Simaroubaceae	*Ailanthus altissima* (Mill) Swingle	MP		Mic
Tiliaceae	*Grewia optiva* Drum. ex. Burret.	MP		Mic
Ulmaceae	*Celtis caucasica* L.		MP	Na
	Celtis eriocarpa Decne.	MP		Mes
Urticaceae	*Debregeasia salicifolia* Roxb.ex D. Don	NP		Mic
Verbenaceae	*Caryopteris odorata* Ham. Ex Roxb.	NP		Mic
	Vitex negundo L.	NP		Mes

Leaf size classes: Ch= Chamaephyte, G= Geophyte; H= Hemicryptophyte; MP= Mesophanerophyte; NP= Nanophenarophyte; Th= Therophyte; Leaf-size classes: L= Leptophyll; Mes= Mesophyll, Mic= Microphyll, Na= Nannophyll.

It was dominated by *Olea ferruginea*, *Dodonaea viscosa*, and *Diplachne fusca* with IV of 79.68, 44.67 and 88.38 respectively (Table 1). *Pinus roxburghii*, *Punica granatum*, *Maytenus royleana*, *Berberis lyceum*, *Debregeasia salicifolia*, *Cynodon dactylon*, *Anagallis arvensis* and *Plantago lanceolata* were important species among herbs. Phanerophytes dominated this community followed by therophytes. The community had predominance of microphyll followed by nanophyll (Table 2).

Table 2. Importance values of the plants in different communities of District Buner, Pakistan

S.No	Plant Species	Family	DOC	CDA	RCA	JCA	Min	Max	Average	Constancy
Tree layer										
1.	*Acacia modesta* Wall.	Mimosaceae	------	------	29.31	------	29.31	29.31	29.31	25
2.	*Ailanthus altissima* (Mill) Swingle	Simaroubaceae	------	53.68***	60.82***	57.97***	53.68	57.97	57.49	75
3.	*Alnus nitida* Mill.	Betulaceae	12.82	------	------	------	12.82	12.82	12.82	25
4.	*Bauhinia variegata* L.	Caesalpinaceae	------	19.23	------	------	19.23	19.23	19.23	25
5.	*Broussonetia papyrifera* L.	Moraceae	------	------	25.46	------	25.46	25.46	25.46	25
6.	*Celtis caucasica* L.	Ulmaceae	18.50	30.41	15.48	------	15.48	30.41	21.46	75
7.	*Celtis eriocarpa* Decne.	Ulmaceae	------	4.38	------	------	4.38	4.38	4.38	25
8.	*Cornus macrophylla* Wall. ex Roxb.	Cornaceae	------	------	------	10.56	10.56	10.56	10.56	25
9.	*Eucalyptus camaldulensis* Dehnh.	Myrtaceae	------	9.92	3.61	------	3.61	9.92	6.76	50
10.	*Ficus carica* L.	Moraceae	------	------	15.92	19.65	15.92	19.65	17.78	50
11.	*Ficus glomerata* Roxb.	Moraceae	------	33.13	------	------	33.13	33.13	33.13	25
12.	*Ficus palmata* Forssk.	Moraceae	9.60	------	------	------	9.60	9.60	9.60	25
13.	*Grewia optiva* Drum. ex. Burret.	Tiliaceae	------	25.69	4.70	25.03	4.70	25.03	18.47	75
14.	*Mallotus phillipensis* Lam.	Euphorbiaceae	24.02	22.57	------	57.13	22.57	57.13	34.57	75
15.	*Melia azedarach* L.	Meliacea	------	------	19.54	14.48	14.48	19.54	17.01	50

16.	*Morus nigra* L.	Moraceae	7.81	------	36.62	------	7.81	36.62	22.21	50
17.	*Morus serrata* Roxb.	Moraceae	------	23.75	------	------	23.75	23.75	23.75	25
18.	*Olea ferruginea* Royle.	Oleaceae	79.68**	32.17	24.45	40.71	24.45	79.68	44.25	100
19.	*Phoenix dactylifera* L.	Arecaceae	------	------	------	27.11	27.11	27.11	27.11	25
20.	*Pinus roxburghii* sarg.	Pinaceae	68.48	36.14	8.64	38.58	8.64	68.48	37.96	100
21.	*Pistacia integrima* J. L. Stewart	Anacardiaceae	21.42	4.34	2.92	------	2.92	21.42	9.56	75
22.	*Populus alba* L.	Salicaceae	------	------	13.21	------	13.21	13.21	13.21	25
23.	*Prosopis glandulosa* Torr.	Mimosaceae	------	------	39.32	------	39.32	39.32	39.32	25
24.	*Punica granatum* L.	Punicaceae	33.46	------	------	4.58	4.58	33.46	19.02	50
25.	*Pyrus pashia* Buchanan-Hamilton	Rosaceae	------	------	------	4.20	4.20	4.20	4.20	25
26.	*Quercus incana* Roxb.	Fagaceae	18.41	------	------	------	18.41	18.41	18.41	25
27.	*Robinia pseudoacacia* L.	Papilionaceae	------	4.59	------	------	4.59	4.59	4.59	25
Shrub layer										
28.	*Andrachne cordifolia*	Euphorbiaceae	------	9.43	------	------	9.43	9.43	9.43	25
29.	*Astragalus leucocephalus* Grah.	Papilionaceae	------	4.26	11.16	------	4.26	11.16	7.71	50
30.	*Berberis lyceum* Royle.	Berberidaceae	33.38	------	------	14.19	14.19	33.18	23.68	25
31.	*Buddleja crispa* Benth.	Buddlejacaceae	------	14.08	------	------	14.08	14.08	14.08	25
32.	*Capparis spinosa* L.	Capparidaceae	------	36.11	------	------	36.11	36.11	36.11	25
33.	*Caryopteris odorata* Ham. Ex Roxb.	Verbenaceae	------	------	------	14.78	14.78	14.78	14.78	25
34.	*Clematis grata* Wall.	Ranunculaceae	------	------	4.41	------	4.41	4.41	4.41	25
35.	*Coelebrookea oppositifolia* Smith	Lamiaceae	18.54	------	------	------	18.54	18.54	18.54	25
36.	*Cotinus coggyria* Scop.	Anacardiaceae	------	------	10.09	------	10.09	10.09	10.09	25
37.	*Debregeasia salicifolia* Roxb.ex D.Don	Urticaceae	30.78	14.89	------	------	14.89	30.78	22.83	50
38.	*Dodonaea viscosa* (Linn) Jacq	Sapindaceae	44.67	54.97**	37.80	45.42	37.80	54.97	45.71	100
39.	*Hedera helix* L.	Araliaceae	------	------	------	14.12	14.12	14.12	14.12	25
40.	*Indigofera heterantha* L.	Papilionaceae	------	9.78	------	------	9.78	9.78	9.78	25
41.	*Justicia adhatoda* L.	Acanthaceae	22.64	22.31	30.50	80.69*	22.31	80.69	39.03	100
42.	*Maytenus royleanus* Wall.ex Lawson	Celasteraceae	39.46	18.46	40.69	54.32	18.46	54.32	38.23	100
43.	*Myrsine africana* L.	Myrsinaceae	5.06	22.84	------	------	5.06	22.84	13.95	50
44.	*Otostagia limbata* Benth.	Lamiaceae	25.71	------	------	------	25.71	25.71	25.71	25
45.	*Reinwardtia trigyna* Roxb.	Linaceae	13.32	25.82	------	------	13.32	25.82	19.57	50
46.	*Rubus fruticosus* Hkf none L.	Rosaceae	26.81	44.05	112.8*	45.72	26.81	112.8	57.34	100
47.	*Rubus ulmifolius* Schott.	Rosaceae	21.26	------	------	------	21.26	21.26	21.26	25
48.	*Sageratia thea* (Osbeck) M.C. Johnst.	Rhamnaceae	------	4.54	------	------	4.54	4.54	4.54	25
49.	*Vitex negundo* L.	Verbenaceae	------	------	------	22.16	22.16	22.16	22.16	25
50.	*Woodfordia fruticosa* (L.) Kurz	Lythraceae	------	4.54	------	------	4.54	4.54	4.54	25
51.	*Zanthoxylum armatum* DC.	Rutaceae	22.88	18.16	22.71	22.72	18.16	22.88	21.61	100
			Herb layer							
52.	*Adiantum capillus-venaris* L.	Adiantceae	9.15	9.44	------	------	9.15	9.44	9.295	50
53.	*Ajuga bracteosa* Wall. Benth.	Lamiaceae	------	12.14	------	------	12.14	12.14	12.14	25
54.	*Alliaria petiolata* (M. Bieb.)	Brassicaceae	24.78	------	------	------	24.78	24.78	24.78	25
55.	*Anagallis arvensis* L.	Primulaceae	32.24	4.81	6.43	24.25	6.43	32.24	16.93	100
56.	*Artimisia absinthium* L.	Asteraceae	14.98	12.42	------	------	12.42	14.98	13.70	50
57.	*Asparagus gracilis*	Asparagaceae	------	------	35.68	------	35.68	35.68	35.68	25
58.	*Athyrium rupicula* Edgew ex hope	Athyriaceae (Fern)	12.84	------	------	------	12.84	12.84	12.84	25
59.	*Cannabis sativa L.*	Canabanaceae	------	------	20.12	19.80	19.80	20.12	19.96	50
60.	*Cymbopogon jwarancusa* (Jones)	Poaceae	------	------	69.67**	68.06**	68.06	69.67	68.86	50
61.	*Cynodon dactylon* (L.) Pers.	Poaceae	50.74***	107.0*	------	13.97	13.97	107.07	57.26	75
62.	*Delphinium uncinatum* Hook & Thomas	Ranunculaceae	------	5.22	------	------	5.22	5.22	5.22	25
63.	*Desmodium tiliafolium D. Don*	Papilionaceae	------	------	5.31	------	5.31	5.31	5.31	25
64.	*Dicliptera bupleuroides* Nees	Acanthaceae	------	16.01	------	------	16.01	16.01	16.01	25
65.	*Diplachne fusca* (Linn.) P. Beauv.	Poaceae	88.38*	------	------	------	88.38	88.38	88.38	25
66.	*Duchesnea indica* (Andrews) Focke	Rosaceae	------	7.85	10.77	21.82	7.85	21.82	13.48	75
67.	*Euphorbia helioscopia* L.	Euphorbiaceae	------	------	13.12	25.91	13.12	25.91	19.51	50
68.	*Heteropogon contortus* (L.) P.Beauv.	Poaceae	------	3.48	------	------	3.48	3.48	3.48	25
69.	*Incarvillea emodi* Royle ex Lindl.	Bignoniaceae	------	4.48	------	------	4.48	4.48	4.48	25
70.	*Lactuca serriola* L.	Asteraceae	------	5.36	------	6.23	5.36	6.23	5.79	50
71.	*Lathyrus sphaericus* L.	Papilionaceae	------	3.42	------	------	3.42	3.42	3.42	25
72.	*Medicago minima* (L.) Grub.	Papilionaceae	------	3.46	14.04	------	3.46	14.04	8.75	50
73.	*Origanum vulgare* L.	Lamiaceae	------	------	------	17.04	17.04	17.04	17.04	25

74.	*Oxalis corniculata* L.	Oxalidaceae	------	3.98	29.91	------	3.98	29.91	16.94	50
75.	*Plantago lanceolata* L.	Plantaginaceae	28.77	23.27	27.07	19.94	19.94	28.77	24.76	100
76.	*Pteris cretica* L.	Pteridaceae (Fern)	6.35	------	------	------	6.35	6.35	6.35	25
77.	*Rumex dentatus* L.	Polygonaceae	------	------	23.33	------	23.33	23.33	23.33	25
78.	*Rumex hastatus* L.	Polygonaceae	15.82	14.47	------	54.80	14.47	54.80	28.36	75
79.	*Saccharum bengalense* Ritz.	Poaceae	------	6.03	------	------	6.03	6.03	6.03	25
80.	*Saussurea heteromalla* (D. Don)	Asteraceae	------	------	9.43	4.75	4.75	9.43	7.09	50
81.	*Scandix pectin-veneris* L.	Apiaceae	------	------	5.72	------	5.72	5.72	5.72	25
82.	*Scilla griffithii* Hochr.	Hyacinthaceae	------	3.62	20.27	------	3.62	20.27	11.94	50
83.	*Stellaria media* (L.) Cry.	Caryophyllaceae	17.24	22.23	------	------	17.24	22.23	19.73	50
84.	*Taraxacum officinale* Weber.	Asteraceae	------	13.95	14.49	9.31	9.31	14.49	12.58	75
85.	*Verbascum thapsus* L.	Scrophulariaceae	-----	3.34	------	------	3.34	3.34	3.34	25
86.	*Vicia peregrima* L.	Papilionaceae	------	9.70	------	------	9.70	9.70	9.70	25
87.	*Vicia sativa L.*	Papilionaceae	------	------	24.49	------	24.49	24.49	24.49	25

Key: (DOC): *Diplachne-Olea-Cynodon* community; (CDA): *Cynodon-Dodonaea-Ailanthus* community (RCA): *Rubus-Cymbopogon-Ailanthus* community; (JCA): *Justicia-Cymbopogon-Ailanthus* community
*- Ist dominant **- 2nd dominant ***- 3rd dominant.

Soil was sandy loam with pH of 7, organic matter 2.20%, low phosphorus (1.13 ppm), potassium (40 ppm) contents and lowest EC of 0.35 dSm^{-1} (Table 3).

Cynodon-Dodonaea-Ailanthus community

The community was recognized at Girari at an altitude between 765-898 m. There were 50 species with 13 trees, 14 shrubs and 23 herbs. *Ailanthus altissima*, *Dodonaea viscosa* and *Cynodon dactylon* prevailed throughout the community with IV of 53.68, 54.97 and 107.07 respectively. Co-dominants included *Ficus glomerata*, *Olea ferruginea, Rubus fruticosus*, and *Capparis spinosa* among woody layer. While among herbs *Plantago lanceolata* and *Stellaria media* were co-dominants. Phanerophytes followed by therophytes were dominant life forms. Microphyll leaf form was most prevalent (Table 2). The soil in this community was sandy loam with pH 7, OM (4.96%), 1.59 ppm P, 60 ppm K and EC 0.5 dSm^{-1} (Table 3).

Table 3. Physico-Chemical analysis of the communities recorded from District Buner.

S.No	Communities	Soil texture	pH	EC dSm^{-1}	Org. Matter %	Phosphorus (available) ppm	Potassium (Available) ppm
1.	DOC	Sandy loam	7	0.35	2.20	1.13	40
2.	CDA	Sandy loam	7	0.5	4.96	1.59	60
3.	RCA	Loam	7.5	0.4	1.24	1.36	60
4.	JCA	Sandy loam	7.2	0.7	3.93	7.72	120

Rubus-Cymbopogon-Ailanthus community

At Elai at 553-590 m a total of 38 species with 14 trees, 7 shrubs and 17 herbs composed the community. *Ailanthus altissima*, *Rubus fruticosus* and *Cymbopogon jwarancusa* were the dominating plants with IV of 60.82, 112.80 and 69.67 respectively. *Prosopis glandulosa*, *Morus nigra* among trees, *Maytenus royleana*, *Dodonaea viscosa* among shrubs, *Asparagus gracilis*, *Oxalis corniculata* among herbs were co-dominant species. Phanerophytes followed by therophytes dominated the community. Microphyll was dominant leaf form in this community. Loamy soil had pH of 7.5, 1.24% organic matter, 60 ppm K and 1.36 ppm P and EC 0.4 dSm^{-1} (Table 3).

Justicia-Cymbopogon-Ailanthus community

The community was present at Jangdara at 765-898 m. It contained 32 species with 11 trees, 9 shrubs and 12 herbs. The dominants were *Ailanthus altissima*,

Justicia adhatoda and *Cymbopogon jwarancusa* with 57.97, 80.69 and 68.06 IV (Table 1). *Mallotus phillipensis*, *Olea ferruginea*, *Maytenus royleana*, *Rubus fruticosus*, *Rumex hastatus* and *Euphorbia helioscopia* were co-dominant species. Phanerophytes followed by therophytes were dominant life forms. Microphyll leaf form was dominant. This community had sandy loam soil with 7.2 pH, high organic matter (3.93), phosphorus (7.27 ppm), potassium (120 ppm) and EC of 0.7 dSm^{-1} (Table 3).

Discussion

The results indicate highly degenerated condition of the area due to deforestation, over-grazing and soil erosion. These factors influence the vegetation structure of an area (Malik *et al*., 2007). Time of sampling and seasonal activities may also be involved in changing the shape of the communities (Malik, 2005). The communities can be conserved by enhancing number of seedlings and reducing disturbance (Siddiqui *et al*. 2009). Four different communities were reported from the study area.

Diplachne-Olea-Cynodon community located at high altitude (1046-1206m) having different climatic conditions as compared to other established communities. Altitude is an important factor for the determination of the vegetation type. The change in altitude consequently changes the floristic composition and community setup (Sakya and Bania, 1998). *Mallotus phillippensis*, *Pistacia integrima*, *Berberis lyceum*, *Maytenus royleana* and *Otostegia limbata*, made the tree and shrub layers respectively while *Anagallis arvensis*, *Plantago lanceolata* and *Alliaria petiolata* contributed to herb layer. *Mallotus phillippensis* and *Otostegia limbata* are unpalatable species which increase under biotic stress like grazing and deforestation of associated species (Malik and Malik, 2004). Small proportion of herbaceous plants (11) occur in the community might be due to man set fires in the area.

Cynodon-Dodonaea-Ailanthus community was established at low altitude ranges from 765-898m showing high species diversity. *Pinus roxburghii*, *Ficus glomerata*, *Morus serrata*, *Olea ferruginea* constituted the tree layer while *Capparis spinosa*, *Myrsine africana*, *Reinwardtia trigyna*, *Rubus fruticosus*, *Rumex dentatus*, *Dicliptera bupleuroides* represented the shrub and herb layers respectively. As a result of dry habitat conditions *Dodonaea viscosa* dominated in the area forming *Dodonaea* Scrub. The area is protected up to some extent by the elders of the area thereby dense vegetation was found. Prevailed domesticated animals contribute highly organic matter to the soil of the community.

Rubus-Cymbopogon-Ailanthus community was developed at the lowest altitude of 553-590m. *Acacia modesta*, *Morus nigra*, *Broussonetia papyrifera*, *Prosopis glandulosa*, *Asparagus gracilis*, *Dodonaea viscosa*, *Maytenus royleana*, *Cannabis sativa*, *Oxalis corniculata* and *Rumex dentatus* were present.

Justicia-Cymbopogon-Ailanthus community was characterized by *Mallotus phillipensis*, *Olea ferruginea*, *Maytenus royleana*, *Rubus fruticosus*, *Rumex hastatus* and *Euphorbia helioscopia*. *Phoenix dactylifera* found only in this community reflects the conservation practices of inhabitants of the area. Allelopathic potentials might be correlated with the spread of *Justicia adhatoda* (Malik and Malik, 2004). Differences occurred in phytosociological attributes; however floristic composition in all the communities remained the same as reported by Hussain *et al*., 2010 and Ahmed *et al*., 2006.

For instance, *Pinus roxburghii* was present almost in all the communities but it had low IV, because of its use by the local inhabitants for different utilities which caused the degradation of the species. The associated ground flora was poor and comprised of only a few species probably due to the periodic fires, overgrazing and soil erosion (Siddiqui *et al*. 2009). Gradual degradation of the communities might be correlated with increased population of the area. So it is tempting to speculate the conservation measures of the precious plant diversity.

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