

Research Article

Communities Structure Dynamics of Plants of Farash Hills Katlang, District Mardan, Pakistan

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ABSTRACT

Phytosociological study of the vegetation of Farash hills Katlang, District Mardan was carried out during April to October 2013. The sites were selected on the basis of physiognomic characters and habitat features. Plants were collected, preserved and identified through flora of Pakistan. Fifteen stands were selected in three different sites, representing different plant communities. A total of 42 plant species belonging to 29 families were identified. Fifteen plants communities were established each having its own composition. Species which dominates these communities were *Spergularia marina*, *Dodonea viscosa*, *Rhazya stricta*, *Otostegia lambata*, *Euphorbia hirta*, *Anagallis arvensis*, *Opuntia dilleni*, *Bromus pectinatus*, *Cenchrus ciliaris*, *Hordeum murinum* and *Ziziphus nummularia*. Physiochemical analysis were find out which is weakly acidic. Ecological parameters such as relative density, relative frequency, and relative canopy cover, constancy, species richness, species diversity, maturity index, community similarity, equitability, degree of homogeneity and floristic diversity was determined. Therophytes (40%) Megaphanerophytes (25%) were dominant in all stands. In leaf form spectra, the analysis revealed that Microphyll (50%), Mesophyll (25%) and Leptophyll (15%) were dominant in all sites.

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INTRODUCTION

Katlang is a Tehsil in the Mardan district of Khyber Pakhtunkhwa Pakistan. The Tehsil lies between 34° – 05' to 34° – 32' North latitudes and 71° – 48' to 72° – 25' East longitudes. It is surrounded north by swat district, on the east by district of Buner, on the South by Mardan city and on the west by Tehsil Takht Bhai. The total area of the Tehsil is 1098573km². The area of Katlang is very fertile. The entire northern side of the Tehsil Katlang is bounded by the hills. The south-western area of Tehsil Katlang is mostly comprised of plains. Climate of the summer season is extremely hot. A steep rise of temperature is observed from May to June. During May and June, dust storms are frequent at night. The temperature reaches its maximum in the month of June i.e. 41.50 C^o. Due to intensive cultivation and artificial irrigation, the treat is humid and heat is oppressive. However a rapid fall of temperature is seen from October on wards. Rainfall is recorded in the month of August. The maximum rainfall was 125.85mm. The relative humidity is quite high throughout the year while maximum humidity has been recorded in August.

Various works has been done in different areas of Pakistan on phytosociology. Nazir et al., (2012) described Phytosociology of the vegetation of Sarsawa Hills District Kotli, Azad Jammu and Kashmir. Shah and Rozina (2013) studied Phytosociological attributes and phytodiversity of Dheri baba hill and Peer Taab Graveyard, District Swabi, KPK, Pakistan. Ahmad et al.,(2006) reported

phytosociology and structure of the Himalayan forests from different climatic zones of Pakistan. Abbas et al., (2009) described phytosociological analysis within the range of Grey Goral in Pakistan and Azad Kashmir. Moinuddin (1988) reported plant communities of some Northern temperate forests of Pakistan. Some other workers also present similar work on Phytosociology from different areas of Pakistan. E.g. Chaudhri and Qadir (1958), Chaudhri (1960, 1961), Qadir et al., (1966), Hussain (1969a,b), Hussain and Qadir (1970), Shaukat and Hussain (1970), Shaukat and Qadir (1970,1972), Ahmed (1974, 1986), Hussain et al., (1991,1981), Amin and Ashfaq (1982), Beg and Khan (1984), Qadri (1986), Rashid et al., (1987), Malik and Hussain (1987), Durrani and Hussain (2005), Khan and Shaukat (2005) and various others presented phytosociological work from different areas of Pakistan.

Literature search of the country clarified that the study area is virgin; therefore, it was considered imperative to document its phytosociology. Current study also will provide a guide for determining vegetation types based on environmental factors such as climate and soil properties of the research area.

MATERIALS AND METHODS

Fifteen stands were randomly selected on the basis of physiognomic characters and habitat features of the vegetation. Phytosociological studies of the selected sites were carried out in April to October, 2013. For the analysis

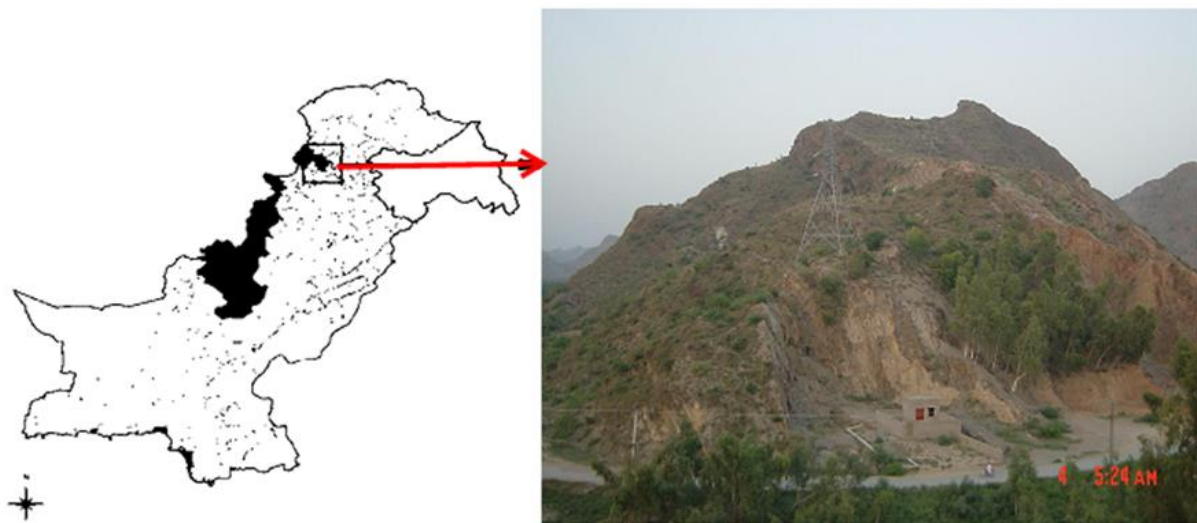


Figure 1: Map of the studied site, District Mardan, Khyber-Pakhtun Khwa, Pakistan

of vegetation Quadrat method were used to calculate density, frequency, canopy cover and their relative values based on physiognomy and habitat of the vegetation. The Quadrat size was 10 x 8 m, 10 x 5 m and 1 x 0.5 m for trees, shrubs and herbs respectively. Physiochemical analysis of soil was carried out for their nature of habitat. Different communities were established based on results. Community attributes like, index of similarity, maturity index, species richness, and diversity were also determined by Sorensen index (1948) and Pichi-Sermollis (1948). Biological spectrums for all plants were calculated. Physiochemical analysis of soil was done after Hussain (1989) and Jackson (1962) using standard methods. Flora were collected from all sites and were dried, preserved and identified in Department of Botany, Abdul Wali Khan University Mardan. Nomenclature followed that of Flora of Pakistan (Nasir and Ali, 1971–1995; Ali & Qaisar, 1995–2007).

RESULTS AND DISCUSSION

Floristic Attributes

A total of 42 plant species belonging to 29 families were recognized. Poaceae had maximum diversity with 6 species followed by Asteraceae (4 spp), Euphorbiaceae and Verbinaceae were represented by (3 spp) Asclepidaceae, Caryophyllaceae and Zygophyllaceae (2 spp). The remaining 20 families each have single representative specie (Table 1). From this study also reported that Poaceae as a well-representing family followed by Asteraceae from Farash hills, Tehsil Katlang.

Biological Spectrum

The life form and leaf size spectra are important physiognomic attributes in vegetation studies. Life form and leaf form classes of the vegetation are also determined according to Raunkier's method (1934). The floristic diversity was determined. Therophytes (40%) Megaphanerophytes (25%) Nanophanerophytes (20%) and Chamaephytes (15%) were dominant in all stands. Shah and Hussain (2009) reported that Therophytes have

dominating properties in all sites in Hayatabad Peshawar and indicate that the habitat support the plants for short lived annuals.

The floristic leaf spectra showed that the analysis revealed that Microphyll (50%), Mesophyll (25%) and Leptophyll (15%) were dominant in all three sites. The leaf form reveled that Microphyll dominates in all stands and shows alternation in the habitats.

Vegetation Structure

The vegetation of the research area consisted of following fifteen communities.

Dodonea – Rhazya – Spergularia Community (DRS)

This community varies in altitude from 410 m to 430 m height and consists of 35 species. 26 species in this community are herbs, and 9 species are shrubby. *Dodonea viscosa*, *Rhazya stricta*, *Spergularia marina*, in these species the *Dodonea viscosa* has the highest importance value 94.43, Therophytes and Megaphanerophytes dominated the site. While the community has mixed leaf spectra of Microphyll and Mesophyll (Table 1).

Rhazya – Dodonea – Otostegia Community (RDO)

The community is present at an altitude of 420 m to 430 m in altitude. Total of 22 species were present in this community, 14 were herbs having importance values and remaining 8 was shrubs with total importance values. This community was dominated by *Rhazya stricta*, *Dodonea viscosa* and *Otostegia lambata*. The importance values were 88.52, 69.25 and 59.65 respectively. The community life form is dominated by Therophytes and Megaphanerophytes while in leaf form spectra Microphyll is the dominating form of community.

Spergularia – Dodonea – Ziziphus Community (SDZ)

Area supporting this community starts from an elevation of 438 m to 446 m. This community was dominated by

Table 1: Floristic list and Biological spectra of the plants of Tehsil Katlang Hills, District Mardan

S. No	Species name	Local name	Family	Leaf form	Life form	Palatability	Livestock
1	<i>Centaurium centaurioides</i> (Roxb.)	Surgulay	Gentianaceae	Mic	TH	+	C,G,B,S
2	<i>Spergularia marina</i> (L.) Grisch.	Spurry	Caryophyllaceae	Le	TH	+	C,G,B,S
3	<i>Lipdium sativum</i> L.		Brassicaceae	Na	TH	+	C,G,B,S
4	<i>Euphorbia helioscopia</i> Mewski.	Mandanoo	Euphorbiaceae	Na	TH	–	–
5	<i>Euphorbia hirta</i> L.	Dodak	Euphorbiaceae	Mic	TH	–	–
6	<i>Cannabis sativa</i> L.	Bhang	Cannabaceae	Na	TH	–	–
7	<i>Saccharum spontaneum</i> Linn.	Kahi	Poaceae	Mic	G	–	–
8	<i>Hordeum murinum</i> L.	Varbashaki	Poaceae	Na	TH	+	C,G,B,S
9	<i>Xanthium stromarium</i> L.	Gishkay	Asteraceae	Mes	CH	–	–
10	<i>Cyperus rotundus</i> L.	Deela	Cyperaceae	Le	H	+	C,G,B,S
11	<i>Anagallis arvensis</i> L.	Gul–boti	Primulaceae	Na	TH	+	C,G,B,S
12	<i>Bromuspectinatus</i> Thunb.	Peshkaygaya	Poaceae	Mes	CH	+	C,G,B,S
13	<i>Amaranthus viridis</i> L.	Chalveri –sag	Amaranthaceae	Mic	TH	+	C,G,B,S
14	<i>Tribulus terrestris</i> L.	Markonday	Zygophyllaceae	Mic	TH	+	C,G,B,S
15	<i>Boerhavia procumbens</i> Banks ex Roxb.,	Ensut	Nyctaginaceae	Na	CH	+	C,G,B,S
16	<i>Loliummultiflorum</i> Lamk.	Mastak	Poaceae	Mic	TH	+	C,G,B,S
17	<i>Cenchrus ciliaris</i> Linn.	Dhaman	Poaceae	Le	TH	+	C,G,B,S
18	<i>Verbascum thapsus</i> L.	Khar–ghwag	Scrophulariaceae	Mes	TH	–	–
19	<i>Peganum harmala</i> L.	Spelanay	Zygophyllaceae	Mic	H	–	–
20	<i>Aspharagusofficinalis</i> L.	Tendori	Liliaceae	Le	G	–	–
21	<i>Inula grandiflora</i> L.	Sthoraygulay	Asteraceae	Mic	TH	+	C,G,B,S
22	<i>Chrozophora tinctoria</i> L.	Unthchara	Euphorbiaceae	Mic	NP	–	–
23	<i>Salvia moorcroftiana</i> Wall.	Khur– Dug	Lamiaceae	Mes	TH	–	–
24	<i>Carthamus lanatus</i> M. Bieb.	Pohli	Compositae	Mic	CH	–	C*
25	<i>Verbena officinalis</i> L.	Shamaki	Verbinaceae	Mic	H	+	C,G,B,S
26	<i>Conyza aegyptica</i> L.	Kharboti	Asteraceae	Le	TH	–	–
27	<i>Filagohurdwarica</i> (Wall.ex Dc.) Wagenitz		Asteraceae	Le	CH	–	–
28	<i>Cynodon dactylon</i> (L.) Pers.	Kabal	Poaceae	Na	H	+	C,G,B,S
29	<i>Spergula arvensis</i> L.	Kalribooti	Caryophyllaceae	Na	TH	+	C,G,B,S
30	<i>Medicago denticulata</i> Willd.	Speshtaray	Papilonaceae	Le	TH	+	C,G,B,S
31	<i>Cleome viscosa</i> L.	Bagra,bagro	Capparaceae	Mic	TH	+	S
Shrubby layer							
32	<i>Dodonea viscosa</i> (L.) Jacq	Ghuraske	Sapindaceae	Mic	NP	–	–
33	<i>Rhazyastricta</i> Decne.	Harmal	Apocynaceae	Mic	CH	–	–
34	<i>Ziziphus nummularia</i> (Burm.f)W.&A	Karkunda	Rhamnaceae	Mic	NP	+	C,G,B,S
35	<i>Ostostegia lambata</i> (Bth) Boiss.	Spen–azghay	Labiatae	Mic	NP	–	–
36	<i>Ficus palmata</i> Forssk.	Inzer	Moraceae	Mes	MP	–	–
37	<i>Opuntia dilleni</i> Haw.	Zukam	Cactaceae	Le	NP	–	–
38	<i>Viburnum foetense</i> Wall. ex Dc.	Chamyaray	Verbinaceae	Mic	MP	+	S

39	<i>Withania somnifera</i> (L.) Dunal	Kutilal	Solanaceae	Mes	CH	-	-
40	<i>Lantana camara</i> L.	Panch phalli	Verbinaceae	Mic	CH	-	-
41	<i>Periploca aphylla</i> Decne.	Barara	Asclepidaceae	Ap	NP	+	C*
42	<i>Calotropis procera</i> (Willd.) R. Br.	Spalmay	Asclepidaceae	Mes	CH	-	-

Note: Leaf Form: Mes= Mesophyll, Mic= Microphyll, Le= Leptophyll, Na= Nanophyll, Meg= Megaphyll, Ap= Aphyllous; Life form: MP= Megaphanerophytes, TH= Therophytes, CH= Chameophytes, G= Geophytes, H= Hemi-Cryptophytes; NP= Nanophanerophytes, L= Lianas; Livestock: C= Cow, G= Goat, B= Buffalo, S= Sheep, C*= Camel.

Table 3: Total number of plant species and percentage of life-form and leaf size classes of research area.

Life-form classes	No. of species	Percentage	Leaf size classes	No. of species	Percentage
Therophytes	19	45.24	Microphyll	18	42.86
Chamaephytes	9	21.43	Leptophyll	9	21.43
Megaphanerophytes	2	4.76	Nanophyll	8	19.05
Hemicryptophytes	4	9.52	Mesophyll	6	16.67
Nanophanerophytes	6	13.90	Aphyllous	1	2.38
Geophytes	2	4.76			

Table 4: Phytosociological attributes and importance values of the plants in different communities of Tehsil Katlang, District Mardan

Habit	Name of Species	DRS	RDO	SDZ	DAZ	RDE	SOD	DRS	ZDS	DOS	DRZ	RDS	DRB	CRD	DHR	OSD	Max	Min	Avg	Constancy
SHRUBS	<i>Dodonea viscosa</i> (L.) Jacq	94.4	69.2	78.0	97.0	97.3	123.9	144.7	98.5	137.4	98.1	101.9	156.2	107.5	146.2	91	156.2	69.2	109.42	100
	<i>Rhazya stricta</i> Decne.	63.3	88.5	53.8	53.4	109.9	34.03	98.1	-	46.8	91.4	106.2	105.6	122.1	86.6	60.6	122.1	34.0	74.68	93.33
	<i>Ziziphus nummularia</i> (Burm.f) W. & A	58.5	42.6	59.3	58.6	39.6	-	-	120.6	-	56.1	-	-	-	-	25.7	120.6	25.7	30.73	53.33
	<i>Otostegia lambata</i> (Bth) Boiss.	29.7	59.6	33	23.7	-	126.7	-	55.8	-	35.2	66.6	-	54.3	51.3	104.3	126.7	23.7	42.68	73.33
	<i>Ficus palmata</i> Forssk.	11.7	18.2	13.6	15.6	18.1	-	-	-	-	-	-	-	-	-	-	18.2	11.7	5.14	33.33
	<i>Opuntia dillenii</i> Haw.	6.4	-	13.9	14.5	-	-	-	-	86.6	18.9	7.5	16.8	-	-	17.5	86.6	6.4	12.1	53.33
	<i>Viburnum foetense</i> Wall. Ex Dc.	3.9	-	4.9	-	-	-	-	6.72	-	-	-	-	-	-	-	6.7	3.9	1.03	20
	<i>Withania somnifera</i> (L.) Dunal.	7.4	4.6	-	-	9.7	-	-	-	-	-	-	-	-	-	-	9.7	4.6	1.44	20
	<i>Lantana camara</i> L.	12.9	-	14.8	4.9	-	-	-	18.1	-	-	5	-	-	-	-	18.1	5	3.71	26.66
	<i>Periploca aphylla</i> Decne.	-	6.7	-	19.5	6.5	15.3	-	-	29.1	-	12.5	-	15.9	15.6	-	29.1	6.5	8.07	53.33
	<i>Calotropis procera</i> (Willd.) R. Br.	-	10.1	-	-	18.7	-	25.1	-	-	-	-	21.3	-	-	-	25.1	10.1	5.01	26.66
	HERBS	<i>Amaranthus viridis</i> L.	-	-	16.9	-	-	-	-	-	-	-	-	-	-	-	-	16.9	-	1.12
<i>Anagallis arvensis</i> L.		23.4	17.4	-	68.5	19.3	38.0	15.0	-	42.2	32.3	44.9	24.8	-	-	57.5	68.5	15.0	25.55	73.33
<i>Asparagus officinalis</i> L.		20.5	37.9	-	23.6	-	27.1	31.6	-	-	-	-	23.5	-	-	-	37.9	20.5	10.94	40
<i>Bromus pectinatus</i> Thunb.		13.3	40.7	-	20.8	33.8	13.7	31.9	-	21.1	-	26	40.7	-	-	-	40.7	13.3	16.13	60
<i>Boerhavia procumbens</i> Bank ex Roxb.		1.9	7.8	7.9	-	-	6.7	-	-	-	-	-	-	-	-	-	7.9	1.9	1.62	26.66
<i>Cannabis sativa</i> L.		13.3	17.9	-	10.7	24.4	-	12.0	8.8	-	39.0	-	-	-	-	-	39.0	8.8	8.40	46.66
<i>Centaurium centaurioides</i> (Roxb.)		9.1	7.3	16.4	15.6	11.0	13.1	12.3	14.7	22.3	23.4	14.9	21.2	37.7	43.0	31.8	43.0	7.3	19.5	100
<i>Cyperus rotundus</i> L.		7.3	-	8.4	-	-	-	-	-	8.6	-	-	-	-	12.2	-	12.2	7.3	2.43	26.66
<i>Cenchrus ciliaris</i> Linn.		18.6	-	21	-	-	13.2	-	18.1	-	-	14.8	-	69	-	-	69	13.2	10.31	40
<i>Chrozophora tinctoria</i> L.		3.2	-	16.3	-	-	-	-	-	-	-	11.5	-	-	-	-	16.3	3.2	2.06	20
<i>Carthamus lanatus</i> M. Bieb.		3.7	-	8.2	-	10.4	2.2	-	7.2	-	-	4.3	-	-	-	-	10.4	3.7	2.4	40
<i>Conyza aegyptica</i> L.		-	10.01	-	-	-	-	-	-	-	-	-	-	-	-	-	10.0	0	0.66	6.66
<i>Cynodon dactylon</i> (L.) Pers.		7.4	-	16.1	-	11.7	-	23.4	-	11.9	-	-	-	-	30.8	-	30.8	7.4	6.75	40
<i>Cleome viscosa</i> L.		7.5	-	16.1	22.0	-	15.1	24.2	19.8	-	-	14.8	-	-	-	-	24.2	7.5	7.96	46.66
<i>Euphorbia helioscopia</i> Mewski.		13.7	-	32.0	-	-	24.8	17.1	28.1	25.8	28.8	20.6	26.1	-	-	-	32.0	13.7	14.6	60
<i>Euphorbia hirta</i> L.		7.4	7.8	-	8.3	46.5	14.1	14.9	9.1	12.7	34.1	-	-	29.9	19.8	-	46.5	7.4	13.6	73.33
<i>Filago hurdwarica</i> (Wall.ex Dc.) Wagenitz		9.3	10.1	-	15.6	-	14.7	-	13.2	-	-	-	-	29.9	-	-	29.9	9.3	6.18	40
<i>Hordeum murinum</i> L.		13.5	32.9	-	29.4	26.9	-	19.2	42.3	32.5	28.2	-	34.7	-	-	71.2	71.2	13.5	22.05	66.66
<i>Inula grandiflora</i> L.	19.3	-	-	-	16.1	7.8	-	-	-	-	32.5	-	-	-	-	32.5	7.8	5.04	26.66	

<i>Lipidium sativum</i> L.	-	-	-	-	-	-	-	6.8	-	-	-	-	-	-	-	6.8	0	0.45	6.66
<i>Lolium multiflorum</i> Lamk.	-	14.31	-	-	-	-	-	-	-	-	-	-	-	-	-	14.3	0	0.95	6.66
<i>Medicago denticulata</i> Willd.	5.4	-	19.2	13.3	13.3	7.5	6.6	12.5	-	-	-	-	44.2	-	-	44.2	5.4	8.13	53.33
<i>Peganum harmala</i> L.	-	-	4.5	-	7.0	-	-	-	-	-	-	-	-	-	-	7.06	4.5	0.76	13.33
<i>Spergularia marina</i> (L.) Griseb.	59.6	58.2	81.1	54.7	40.0	70.4	53.9	64.0	77.0	47.5	66.3	38.6	65.5	65.1	100.2	100.2	38.6	62.8	100
<i>Spergula arvensis</i> L.	2	11.7	8.6	2.8	-	-	-	18.9	4.4	-	-	-	-	-	-	11.7	2	3.22	40
<i>Salvia moorcroftiana</i> Wall.	5.7	-	11.9	-	7.6	-	9.3	-	-	-	-	-	-	-	-	11.9	5.7	2.3	26.66
<i>Saccharum spontaneum</i> Linn.	9.1	-	7.9	-	-	-	2.0	11.2	8.6	16.4	6.1	26.8	-	-	39.0	26.8	2.07	8.47	60
<i>Tribulus terrestris</i> L.	12.8	25.4	-	-	23.2	18.5	-	-	25.5	-	32.1	-	-	-	-	32.1	12.8	9.16	40
<i>Verbascum thapsus</i> L.	8.6	-	11.6	-	-	5.2	-	10.3	-	-	-	-	23.5	-	-	23.5	5.2	3.94	33.33
<i>Verbena officinalis</i> L.	5.4	-	-	-	11.7	-	11.4	-	-	-	-	26.1	-	-	-	26.1	5.4	3.64	26.66
<i>Xanthium stromarium</i> L.	3.8	-	11.3	-	-	7.1	-	-	6.8	14.3	-	-	-	12.2	-	14.3	3.8	3.7	40

Spergularia marina, *Dodonea viscosa* and *Ziziphus nummularia*. The importance values of the species are 81.16, 78.01 and 59.36 respectively. This community contains total of 24 species 7 shrubs and the remaining are herbs. The Megaphanerophytes and Therophytes are the predominant life form in the community with Microphyll leaf form the (Table 1).

Dodonea – Anagallis – Ziziphus Community (DAZ)

This community is present next to the 3rd community with the same altitude. *Dodonea viscosa*, *Anagallis arvensis*, *Ziziphus nummularia* were the dominating species of community with importance values 97.08, 68.55 and 58.69 respectively. This community was dominated by Megaphanerophytes. In leaf spectra Microphyll was the dominant class of the community. The community consists of 13 herbs and 9 shrubs species having no trees strata

Rhazya – Dodonea – Euphorbia Community (RDE)

Rhazya stricta, *Dodonea viscosa* and *Euphorbia hirta* Community stretched between 410m – 430m elevation. The community consists of a total 23 species. *Rhazya stricta* and *Dodonea viscosa* were among the shrubs and *Euphorbia hirta* were among herbs. No trees strata were observed in this community. *Rhazya stricta*, *Dodonea viscosa* and *Euphorbia hirta* with the importance values 109.95, 97.31 and 46.51 respectively. Megaphanerophytes was dominated this community. In leaf spectra Microphyll was the dominant class of the community.

Spergularia – Otostegia – Dodonea Community (SOD)

At 460 m height this community comprised 21 species. In the beginning the slope was steep but became gentle the top. There were 4 shrubs and 17 herbs. The contribution by percentage shrubs was 25% and herbs 75%. *Spergularia marina*, *Otostegia lambata* and *Dodonea viscosa* dominated with importance values 126.71, 123.90 and 70.43 respectively. Therophytes can dominate the community. Whereas leaf size spectrum was dominated by Microphyll and Nanophyll.

Dodonea – Rhazya – Spergularia Community (DRS)

This community started from altitude 420 m to 450 m. The stand is supported by 20 species four of which are shrubs, and 16 species are herbaceous. *Salvia moorcroftiana* are introduced as new species thus the community have different floristic composition than the other stands. Soil of this stand is fertile and sandy loam suitable for the growth of the shrubby species. *Dodonea viscosa*, *Rhazya stricta* and *Spergularia marina* dominated the community having Importance values 144.72, 98.15 and 53.97 respectively.

Ziziphus – Dodonea – Spergularia Community (ZDS)

This stand starts from the upper top portion of the hill which separates it by its slope. Total of 21 species, 5 species were shrubs and the remaining are herbs. The community was dominated by *Ziziphus nummularia*, *Dodonea viscosa* and *Spergularia marina*. The importance values were 120.62, 98.59 and 64.01 respectively. Biological spectra shows that Therophytes and Nanophanerophytes dominant while leaf form by Microphyll.

Dodonea – Opuntia – Spergularia Community (DOS)

This community extended from 450m to 470m in altitude. The community was dominated by *Dodonea viscosa*, *Opuntia dillenii* and *Spergularia marina*. The importance values of the species were 137.36, 86.63 and 77.06 respectively. Community contains total of 17 species, 4 of which shrubs and 13 are herbs. Therophytes and Chameophytes dominated the life form while leaf form spectra by Microphyll.

Dodonea – Rhazya – Ziziphus Community (DRZ)

Dodonea viscosa, *Rhazya stricta*, *Ziziphus nummularia* were the dominating species of community with importance values 98.12, 91.49 and 56.17 respectively. This is the only stand which is dominated by shrubby species. Community is dominated by Therophytes. In leaf form spectra Microphyll was the dominant class. The community is consists of 15 species in which 5 were shrubs.

Rhazya – Dodonea – Spergularia Community (RDS)

The vegetation of this community is supported by 18 species out of which 6 are shrubs and the remaining 12 are herbs species. This community lies at an elevation of 470 m – 480 m. The percentage of herbs and shrubs plants is 55% and 45% in this stand in which community is dominated by *Rhazya stricta*, *Dodonea viscosa* and *Spergularia marina*. The importance values of the species are 106.25, 101.94 and 66.35 respectively. Therophytes and Nanophanerophytes are the dominant life form and Microphyll are the dominant leaf form.

Dodonea – Rhazya – Bromus Community (DRB)

This stand is stretched up to the end of the West facing hills. This community is dominated by *Dodonea viscosa*, *Rhazya stricta* and *Bromus pectinatus*. Community is supported by 13 species, 04 are shrubs and 09 are herbs. Climatic conditions are very suitable for the growth of the shrubby species. The Importance values of the species are 156.23, 105.61 and 40.70 respectively. Therophytes and Chameophytes were the predominant species in the community with Microphyll leaf form.

Cenchrus – Rhazya – Dodonea Community (CRD)

Cenchrus ciliaris, *Rhazya stricta* and *Dodonea viscosa* community have an elevation of 470m – 480m. The community is dominated by *Cenchrus ciliaris*, *Rhazya stricta* and *Dodonea viscosa*. The importance values of the dominant species are 69.06, 59.2 and 48.5 respectively. This community is supported by 11 species in which 04 are shrubby. This community was dominated by Therophytes. In leaf form spectra Microphyll was the dominant class of the community.

Dodonea – Hordeum – Rhazya Community (DHR)

This stand has an elevation of 470 m. This stand shows more diversity as compare to other stands of the hill. It has the same vegetation but having the presence of *Hordeum murinum* as well as some small under story plants. This community contains a total 11 species but dominated by *Dodonea viscosa*, *Hordeum murinum* and *Rhazya stricta*. Importance values of the dominant species are 146.27, 116.63 and 86.67 respectively. Therophytes and Chameophytes are the dominant life form while Microphyll are the leaf form.

Otostegia – Spergularia – Dodonea Community (OSD)

Otostegia lambata, *Spergularia marina*, *Dodonea viscosa* were the dominant species of this community with importance values 104.39, 100.26 and 91.00 respectively. This community was dominating by Nanophanerophytes and Therophytes. The predominant leaf form was Microphyll were observed in this stand. The community was recognized at an altitude of 480 m. The community consists of 5 shrubs and 5 herbs and no tree species.

Community Characteristics

Indices of Similarity

From the study of these fifteen communities it shows a high degree of changes among in respect to the indices of similarities. *Dodonea*, *Rhazya*, and *Spergularia* Community shows the highest degree of similarity with *Spergularia*, *Dodonea*, and *Ziziphus* Community (37.2%) while the lowest degree of similarity with *Cenchrus*, *Rhazya* and *Dodonea* (17.13%). From the Table (5) we can see the index of similarity of all species.

Table 5: Index of similarity between fifteen communities of Tehsil Katlang Hills, District Mardan

	DRS	RDO	SDZ	DAZ	RDE	SOD	DRS	ZDS	DOS	DRZ	RDS	DRB	CRD	DHR	OSD
DRS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RDO	29.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SDZ	37.2	17.39	-	-	-	-	-	-	-	-	-	-	-	-	-
DAZ	35.08	35.55	21.73	-	-	-	-	-	-	-	-	-	-	-	-
RDE	32.75	31.11	23.4	28.88	-	-	-	-	-	-	-	-	-	-	-
SOD	35.71	30.23	28.88	30.23	29.54	-	-	-	-	-	-	-	-	-	-
DRS	30.9	28.57	17.39	30.95	27.9	26.82	-	-	-	-	-	-	-	-	-
ZDS	35.71	27.9	33.33	30.23	25	30.95	29.26	-	-	-	-	-	-	-	-
DOS	28.84	25.64	24.39	23.07	27.5	28.94	35.13	23.68	-	-	-	-	-	-	-
DRZ	28	29.72	25.64	32.43	23.68	25	28.57	33.33	34.37	-	-	-	-	-	-
RDS	32.07	22.5	24.19	30	24.39	35.89	26.31	30.76	28.57	30.3	-	-	-	-	-
DRB	25	25.71	18.91	25.71	22.22	23.52	36.36	20.58	33.33	28.57	28.12	-	-	-	-
CRD	21.73	21.21	22.85	27.27	23.52	34.37	19.35	28.12	21.42	23.07	24.13	20.68	-	-	-
DHR	21.73	24.24	22.85	21.21	23.52	25	22.58	21.87	35.71	30.76	20.68	25	31.81	-	-
OSD	22.22	25	23.52	28.12	21.21	19.35	23.33	22.58	29.62	40	28.57	34.78	19.04	23.8	-

Key Note: DRS= *Dodonea – Rhazya – Spergularia*, RDO= *Rhazya – Dodonea – Otostegia*, SDZ= *Spergularia – Dodonea – Ziziphus*, DAZ = *Dodonea – Anagallis – Ziziphus*, RDE= *Rhazya – Dodonea – Euphorbia*, SOD= *Spergularia – Otostegia – Dodonea*, DRS= *Dodonea – Rhazya – Spergularia*, ZDS= *Ziziphus – Dodonea – Spergularia*, DOS= *Dodonea – Opuntia – Spergularia*, DRZ= *Dodonea – Rhazya – Ziziphus*, RDS= *Rhazya – Dodonea – Spergularia*, DRB= *Dodonea – Rhazya – Bromus*, CRD= *Cenchrus – Rhazya – Dodonea*, DHR= *Dodonea – Hordium – Rhazya*, OSD= *Otostegia – Spergularia – Dodonea*,

Table 6: Co-efficient of Communities of different Stands of Tehsil Katlang Hills, District Mardan

S. No	Communities	S.R	S.D	M.I	EQU
1	<i>Dodonea – Rhazya – Spergularia</i>	1.036	2.8	38	0.28
2	<i>Rhazya – Dodonea – Otostegia</i>	0.7124	2.5	51.36	0.29
3	<i>Spergularia – Dodonea – Ziziphus</i>	0.94	2.6	35.41	0.3
4	<i>Dodonea – Anagallis – Ziziphus</i>	0.78	2.7	45	0.32
5	<i>Rhazya – Dodonea – Euphorbia</i>	0.9	2.8	39.56	0.32
6	<i>Spergularia – Otostegia – Dodonea</i>	0.74	2.5	40.95	0.3
7	<i>Dodonea – Rhazya – Spergularia</i>	0.75	2.6	45	0.31
8	<i>Ziziphus – Dodonea – Spergularia</i>	0.94	2.6	37.14	0.31
9	<i>Dodonea – Opuntia – Spergularia</i>	0.81	2.3	34.7	0.29
10	<i>Dodonea – Rhazya – Ziziphus</i>	0.84	2.3	36	0.3
11	<i>Rhazya – Dodonea – Spergularia</i>	0.83	2.3	39.44	0.28
12	<i>Dodonea – Rhazya – Bromus</i>	0.74	2.2	41.53	0.3
13	<i>Cenchrus – Rhazya – Dodonea</i>	0.75	1.9	40.9	0.26
14	<i>Dodonea – Hordium – Rhazya</i>	0.86	1.9	33.63	0.26
15	<i>Otostegia – Spergularia – Dodonea</i>	0.68	3.7	46	0.56

Key Note: S.R= Species richness, S.D= Species Diversity, M.I= Maturity index, EQU= Equitability

Species Richness in Different Communities

The species richness appeared to be different among the all fifteen communities and range from 0.68 (OSD) to 1.036 (DRS) and the values of the different communities are given in (Table 5).

Species Diversity in Different Communities

Species diversity showed that highest diversity was observed in OSD community (3.7) followed by RDE (2.8) and minimum diversity of (1.8) CRD (Table 5).

Degree of Maturity in Different Communities

Degree of maturity (Table 5) the RDO community had the highest value (51.36) followed by OSD community (46) and lowest degree of maturity for DHR community (33.63) respectively.

Equitability of Species in Different Communities

The highest Equitability shows by the OSD community (0.56) followed by DAZ community (0.32) and the lowest evenness of CRD and DHR community 0.26 (Table 5).

CONCLUSION

From this study it is concluded that the vegetation of Katlang Hills shows a very poor woody flora and dominated by Herbaceous and Shrubby flora. The less number of woody plants because the peoples cut it for various purposes. Due to this fact the Phytosociological analysis and floristic diversity of the vegetation is retard. Therophytes which are either annual or biennials are the dominated species. Richest families were Asteraceae and Poaceae. The dominant leaf spectrum is that of Microphyll in the present study.

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CONFLICT OF INTEREST

There is no conflict of interest among the authors.

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