Research Article

Phytodiversity Assessment of Maidan Valley Dir Lower, Khyber Pukhtunkhwa, Pakistan

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Abstract | This study aims to assess the phytodiversity assessment of the vegetation of Maidan valley Lower Dir, Pakistan. Field surveys were conducted during different seasons from 2023-2024 to document plant diversity across the study area. The region covers approximately 300 km^2 and lies along an elevation gradient of 1800-2000m. Based on physical characteristics, the area was divided into 34 sampling sites. A total of 121 plant species belonging to 108 genera and 62 families were collected and identified. Rosaceae was the dominant family with 14 species, followed by Poaceae (11 species) and Asteraceae (10 species). In terms of growth habit, herbs were dominant (57%), followed by trees (26%), and shrubs (17%). Perennial species constituted the majority (74%), followed by annuals (25%) and biennial (1%). Dicotyledons were dominant (79%), followed by monocots (15%), gymnosperms (4%), and pteridophytes (2%). According to Raunkiaer's life form classification, therophytes were dominant (65%). The leaf size spectrum was dominated by microphylls (56%). Ethnobotanical uses of several plant species were also documented. PC-ORD analysis identified four major plant communities; *Imperata-Indigofera- Avena* (IIA) Community, *Nastestum-Anemone- Diospyros* (NAD) community, *Olea-Rosa-Avena* (ORA) community, *Cotoneaster- Polygonum- Ajuga* (CPA) community.

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Introduction

Plants are regarded as a crucial element of global sustainability and provides various ecosystem services (Bettin et al., 2023). Phytodiversity can be defined as the differences in floristic composition, genetic variations, and the ecosystem in which plant species are part of. It describes the measure of abundance, variety, and variability in plants. Biotic stresses such as uncontrolled grazing, logging, use

of plants for timber and fuelwood, deforestation for cultivation and road constructions have drastically deteriorated forests in the Kashmir Himalaya (Altaf et al., 2022). Plant communities were sampled for species composition and relative abundance, using the Braun-banquet method (Asongwe et al., 2022). The floristic diversity of any area plays an important role in the sustainable livelihood and food security of the inhabitants of that area (Perveen et al., 2021). In addition to being naturally diverse, plants are also used by humans and other animals for a variety of functions, including food, shelter, health care, and the preservation of life. Pakistan is a developing nation where people rely on plants to meet their everyday requirements. Due to their topography, temperature, and geological history, mountain ecosystems around the world typically include diverse biological communities and a high level of plant species variety. The study of plant communities and their classification is referred to as phytosociology. The science of plant communities, their relationships with their ecosystems, and the mechanisms that modify them is known as phytosociology. Similar to a community, a plant community is any kind of plants that have similar ecological requirements, capabilities, and geographical location. The phytosociological research on such a broad range of flora can be a helpful point of departure for future analyses and management of biodiversity (Kenar et al., 2020).). The distribution of plant species and their structure as communities are heavily determined by edaphic and climatic factors and plant communities are not only a representation of the time period but also a sign of environmental consequences (Kharkwal and Rawat, 2010). The aims and objectives of the current study are 1) To assess the floristic composition, species richness, and ecological distribution pattern of plant communities 2) To document and identify plant species, analyze life form and leaf size spectra, evaluate biodiversity indices and community structure, and assess anthropogenic impacts on phytodiversity in Maidan Valley, Dir Lower, Khyber Pukhtunkhwa, Pakistan.

Methods and Materials

The research area was studied during the various months of 2023-2024. The current study includes vegetation diversity analysis in Maidan valley Dir lower. The study was based on field data. The field data was based on standard sampling techniques. Quantitative attributes i.e. density, cover and frequency of plant species were measured along altitudinal transects using a quadrat method (Irfan *et al*., 2018). The whole valley (about 300 km^2) were divided into 34 sampling localities. For a better understanding of vegetation structure and diversity variation both altitude and aspects were kept in mind during sampling.

Study area

Maidan valley is located in Dir Lower, Khyber Pakhtunkhwa covering an area of 300 km2 lying between 34˚37' to 35˚07' N Latitudes and 71˚31' to 72˚14' E longitudes. It is bounded in the east by Upper Dir, North by Barwal Banda, South by Haji Abad and Koto, and in the West by Jandool. The topography of the valley is dominated by Hindukush Mountains and hills. The summer season is moderate and hot, June and July are the hottest months and in June maximum and minimum temperature has been recorded as 32.52˚C and 15.67˚C respectively. The winter season is cold and severe the temperatures rapidly decrease from November onwards. December, January, and February are very cold months, during these months the temperature fall below the ˚C. The maximum and minimum temperature during January was recorded as 11.22˚C and -2.39˚C respectively. Most of the population of the area is involved in farming, agriculture, horticulture and sericulture (Irfan *et al*., 2018). Maidan valley is connected towards north with upper dir district and share its boundaries towards east with swat district, towards south connected with Malakand district and connected with Afghanistan and Bajaur agency on west side (Irfan *et al*., 2018) (Figure 1).

Sampling techniques

Quadrat method was used to sample the area with rectangular quadrats of varied sizes for trees, shrubs and herbaceous vegetation respectively. The quadrat consisted of 1×1 for herbs, 5×5 for shrubs and 10×10 for trees were used. The arrangement of quadrates was based on systematic grid of laid out in the study area. Samples positions of each quadrat were recorded by using "Garmin" global positioning system (GPS). Phytosociological parameters like density and relative density, frequency and relative frequency (Daubenmire 1959) and IVI of each stand were recorded. The name of each plant community was based on three indicator species (Yanai ,1992).

Data collection

Field survey was carried out in order to investigate the

vegetation type and plant species diversity. During field survey plants specimens were collected, tagged and captured through camera. Phenological stages of plant species at different seasons (i.e. spring, summer and autumn) were recorded (Singh and Singh, 2010). The field data included local name, family names, habit, habitat, and locality (Singh and Singh, 2010). The plant specimens were properly tagged, pressed, poisoned, and pasted on 11.5 X 16.5 inches' herbarium sheets. Information's in the field note book were transferred to the labelling slip pasted on right side at the bottom of herbarium sheets. The plant specimens were identified with the help of Flora of Pakistan and taxonomic experts (Ali and Qaiser, 1993-2017). The ethnobotanical species and other appropriate information's were also collected.

Life form spectrum

To classify the recorded plants in to different life form classes (i.e. adaptation to biological spectrum and climatic conditions), Raunkiaer system of classification 1934 was followed, phanerophytes. Phanerophytes are further divided into sub classes, Megaphanerophytes, Mesophanerophytes, Microphanerophytes, Nanophanerophytes, Chamaephytes, Hemicryptophytes, Geophytes, and Therophytes.

Leaf size spectrum

According to Raunkiaer (1956) classification the different plant species are classified into the following categories, Leptophyll, Nanophyll, Microphyll, Mesophyll, Macrophyll, and Megaphyll.

Classification and ordination

To analyze and classify the vegetation types of the study area with respect to different environmental gradients, multivariate techniques were used. For classification of plant communities cluster analysis was used in R- software (PC ORD) for Window 2007. A distance matrix of vegetation quadrates was calculated by using Bray-Curtis method and then clustering was carried out on distance matrix using wards method (1961). Detrended Correspondence Analysis (DCA) was used to lay vegetation plots in relation to similarity in plant species composition. DCA is an Eigen analysis ordination technique that is based on reciprocal averaging (Hill, 1973), and has become one of the most widely used procedure in vegetation science. Detrended correspondence analysis (Hill and Gauch, 1980) will be used to examine the pattern of vegetation composition and structure across the study area while ecological species groups or vegetation types will be exposed by means of cluster analysis.

Phytosociological attributes

The phytosociological attributes were calculated according to (Ahmed, 2010). Important value index was used for ranking the plant species in the community. The plant species with the maximum importance value in the stand was considered the leading species. On the basis of dominant species each plant community was named accordingly. Plant species followed the dominants were categories into co-dominants, associates and rare. 15 Different parameters like density, cover, frequency, relative density, relative cover and relative frequency for each species was calculated (Awan et al, 2021).

Results

The current study comprised sum of 121 plant species belong to 108 genera and 62 families. The most dominant family was Rosaceae with 14 species, followed by Poaceae with 11 species, Asteraceae with 10 species, Lamiaceae with 9 species, Pinaceae with 5 species, Moraceae with 4 species, Urticaceae and Polygonaceae with 3 species, Euphorbiaceae, Brassicaceae, Plantaginaceae, Chenopodiaceae, Ranunculaceae, Papilionaceae, Papaveraceae, Oleaceae, Fabaceae, Salicaceae, Amaranthaceae and Ebenaceae with 2 species. Each remaining families viz. Fagaceae, Berberidaceae, Violaceae, Oxalidaceae, Cannabaceae, Liliaceae, Amaryllidaceae, Cyperaceae, Colchicaceae, Valeriacea, Saxifragaceae, Nyctaginaceae, Thymelaeaceae, Carophyllaceae, Sapindaceae, Verbenaceae, Buxaceae, Convolvulaceae, Caprifoliaceae, Punicaceae, Equisetaceae, Meliaceae, Hamamelidaceae, Simarubaceae, Juglandaceae, Malvaceae, Rhamnaceae, Platanaceae, Myrtaceae , Betulaceae Oxalidaceae, Apocynaceae, Balsaminaceae, Rutaceae, Solanaceae, Equisetaceae ,Rubiaceae, Aspleniaceae, and Ulmaceae with one species. (Table 1, Figure 2).

Floristic characteristic of the vegetation

The table 2 shows the floristic details of the vegetation, classified by different criteria i.e. plant wise, Family wise, Habit wise, Life form, Raunkiaer life form and Leaf size class/spectrum (Table 2, Figure 3, 4, 5, 6, &7).

Table 1: *List of families of the plant species recorded from the study area.*

S. No	Family name	No of plants species
1	Rosaceae	14
2	Poaceae	11
3	Asteraceae	10
4	Lamiaceae	9
5	Pinaceae	5
6	Moraceae	4
7	Urticaceae	3
8	Polygonaceae	3
9	Scrophulariaceae	2
10	Caryophyllaceae	2
12	Plantaginaceae	2
13	Chenopodiaceae	2
14	Ranunculaceae	2
15	Papilionaceae	2
16	Papaveraceae	2
17	Oleaceae	2
18	Fabaceae	2
19	Amaranthaceae	2
20	Brassicaceae	2
21	Ebenaceae	2
22	Euphorbiaceae	2
23	Salicaceae	2
24	Fagaceae	1
25	Cannabaceae	1
26	Liliaceae	1
27	Amaryllidaceae	1
28	Cyperaceae	1
29	Colchicaceae	1
30	Valeriacea	1
31	Saxifragaceae	1
32	Nyctagiceaea	1
33	Balsaminaceae	1
34	Thymelaeaceae	1
35	Carophyllaceae	1
36	Sapindaceae	1
37	Verbenaceae	1
38	Buxaceae	1
39	Convolvulaceae	1
40	Caprifoliaceae	1
41	Punicaceae	1
42	Equisetaceae	1
43	Meliaceae	1
44	Hamamelidaceae	1
45	Salicaceae	1
46	Juglandaceae	1
48	Malvaceae	1
49	Rhamnaceae	1
50	Platanaceae	1
51	Myrtaceae	1
52	Betulaceae	1
53	Berberidaceae	1
54	Apocynaceae	1
56	Oxalidaceae	1
57	Simarubaceae	1
58	Ulmaceae	1
59	Violaceae	1
60	Solanaceae	1
61	Rutaceae	1
62	Aspleniaceae	1

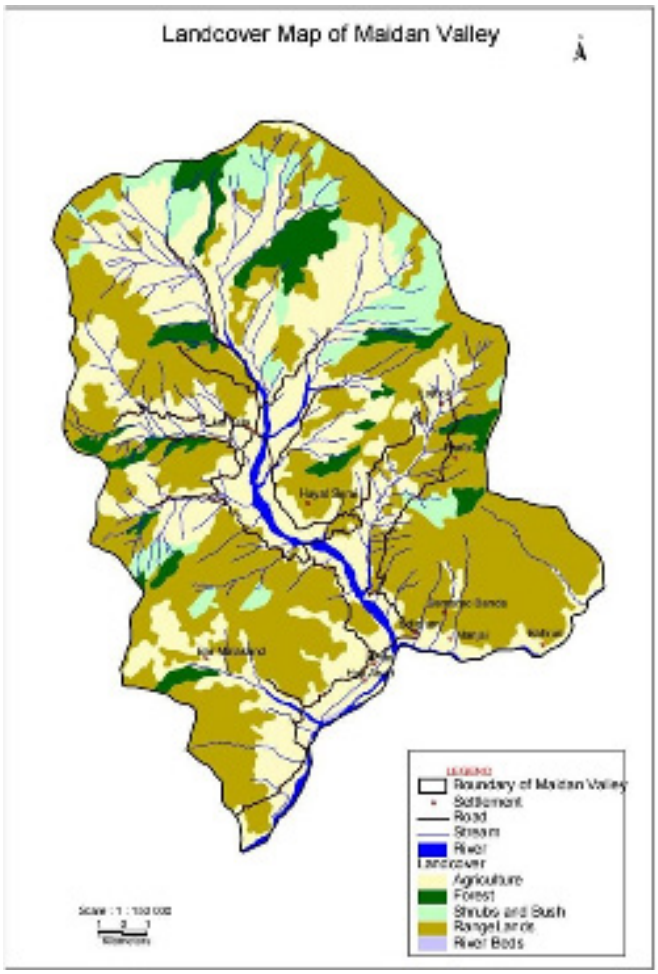

Figure 1: *Pictorial view of the map of the study area maidan valley, district dir lower, khyber pukhtunkhwa, pakistan.*

Note: H (Herb), S (Shrub), T (Tree), D (Dicot), M (Monocot), G (Gymnosperm), Pt (Pteridophyta), A (Annual) B (Biennial), P (Perennial). Mi (Microphyll); Na (Nanophyll); Le (Leptophyll); Me (Megaphyll);

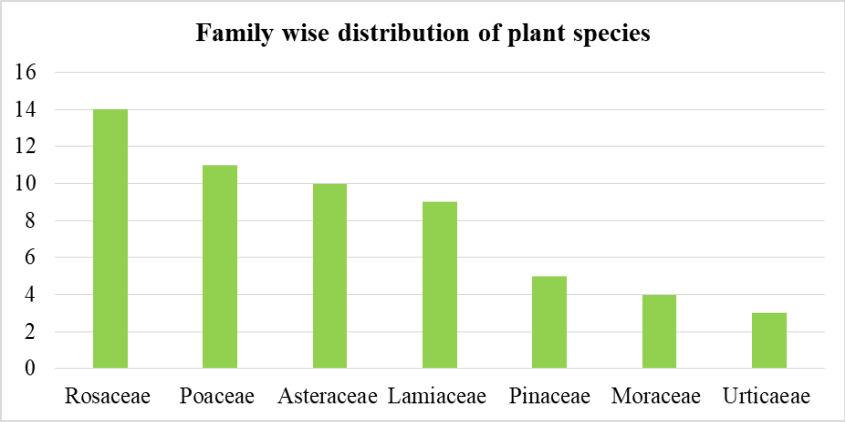

Figure 2: *Family wise distribution of plant species from the study area.*

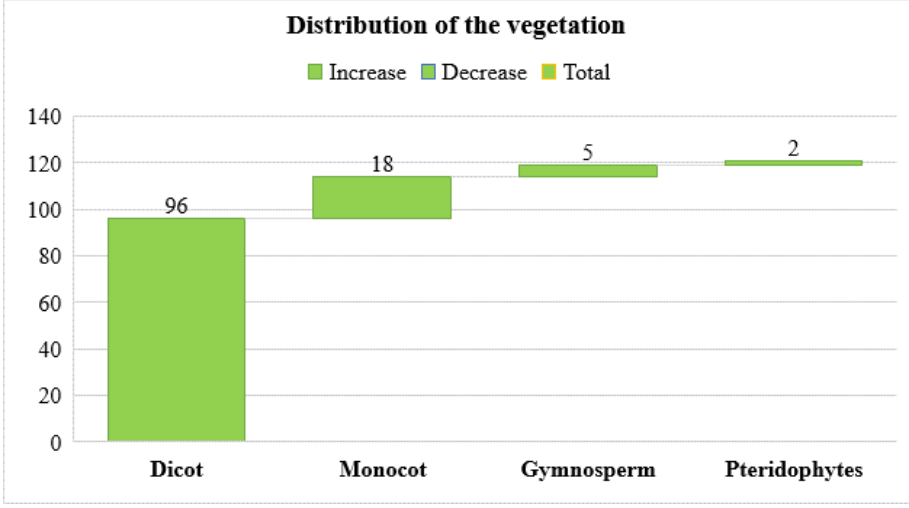

Figure 3: *Monocot, Dicot, Gymnosperm, pteridophytes distribution of the vegetation recorded during the survey.*

Ms (Mesophyll); NP (Nanophanerophyte); MP (Macrophanerophyte); HP (Hydrophyte); CH (Chaemephyte); GP (Geophyte); TH (Therophyte) HP (Cryptophytic); HCP (Hemicrptophyte), L (Liana).

Monocot, dicot, gymnosperm, and pteridophytes distribution

The results showed that the dicot 96 plants (79%) are dominant in all communities, The Monocot are 18 specie with (15%), Gymnosperm 5 (4%) and Pteridophytes are 2 species (2%) respectively. (Figure 3).

Life span spectrum

The result indicate that the dominant life span were perennial plants 78 with (64%), 40 annual plants with (33%), 3 Biennial (3%) (Figure 4).

Plant habit

The results showed that the herb 69 species with 57 % are dominant in all communities, trees 32 species with 26 %, the shrub 20 species with 17 % are very less as compare to all other plants in all communities (Figure 5).

Leaf size class/spectrum

The result indicates that the dominant Leaf size were Microphyll 65 specie with 56%, Nanophyll 28 species with 24%, Mesophyll 4 species with 4%, Megaphyll 12 species with 10%, and Leptophyll 7 species with 6%. **Note:** MI (Microphyll), NA (Nanophyll), LE (Leptophyll), ME (Megaphyll), MS (Mesophyll). (Figure 6).

Raunkiaer life form

By using Raunkiaer life form the result suggest that the dominant life form was Macrophanerophyte 7 species with 9%, Therophyte were 45 species with 65%, Nanophanerophyte 16 species with 20%, Geophyte 7 species with 9%, Hemicrptophyte 4 species with 5%, and Chamaephyte with 1 species 1%. **Note:** NP (Nanophanerophyte), MP (Macrophanerophyte), HP (Hydrophyte), CH (Chamaephyte), GP (Geophyte), TH (Therophyte), HCP (Hemicrptophyte). (Figure 7).

Table 2: *Floristic composition of the species from the study area.*

S. No	Botanical name	Local name	Family	Habit	M/D/G/Pt	LS	RLF	LSS
1	*Abies pindrow* Rolye.	Kachal	Pinaceae	T	Gym	P	MP	Na
2	*Ajuga bracteosa* Wall ex Benth.	Goti	Lamiaceae	H	D	P	TH	Mi
3	*Ajuga parviflora* Buch. Ham.	Goti	Lamiaceae	H	D	P	TH	Mi
4	*Alianthus altissima* (Mill.) Swingle	Spina shandi	Simarubaceae	T	D	P	MP	Me
5	*Alnus nitida* (Spach) Endl.	Gira	Betulaceae	T	D	P	MP	Ms
6	*Amaranthus viridis* L.	Churli	Amaranthaceae	H	D	A	MP	Ms
7	*Anemone tetrasepala* Royle	Spin gully	Ranunculaceae	H	D	P	TH	Mi
8	*Aristida adscensionis* L.	Kanto wakho	Poaceae	H	M	A	TH	Mi
9	*Artemisia maritima* L.	Tarkha	Asteraceae	H	D	P	NP	Mi
10	*Artemisia dubia* Wall.	Tarkha	Lamiaceae	H	D	P	NP	Mi
11	*Arundo donex* L.	Durma	Poaceae	H	M	P	GP	Me
12	*Avena fatua* L.	Judar	Poaceae	H	M	A	TH	Mi
13	*Berberis lyceum* L.	Kory	Berberidaceae	S	D	P	NP	Mi
14	*Bergenia ciliate* Haw. Sternb	Winter begonia	Saxifragaceae	H	D	P	GP	Me
15	*Broussonetia papyrifera* L.	Gultoot	Moraceae	T	D	P	MP	Me
16	*Buddleia crispa* Benth.	Pani botty	Scrophular-iaceae	S	D	P	TH	Mi
17	*Cannabis sativa* L.	Bang	Cannabaceae	H	D	A	TH	Mi
18	*Carthamus oxycantha* M. Bied	Kariza	Asteraceae	H	D	A	TH	Mi
19	*Cedrus deodara* (Roxb. Ex D.Don	Diar	Pinaceae	T	Gym	P	MP	Na
20	*Celtis australis* L.	Taghago	Ulmaceae	T	D	P	MP	Mi
21	*Cenchrus ciliaris* L.	Peshogi wakho	Poaceae	H	M	A	TH	Le
22	*Chenopodium album* L.	Sarma	Chenopodiaceae	H	D	A	TH	Mi
23	*Chenopodium ambrosioides* L.	Sarma	Chenopodiaceae	H	D	A	TH	Mi
24	*Chloris virgate* L.	Kabal	Poaceae	H	M	A	TH	Mi
25	*Colchicum luteum* Baker	Zirgula	Colchicaceae	H	M	P	GP	Mi
26	*Convolvulus arvensis* L.	Perwati	Convolvaceae	H	D	P	GP	Na
27	*Cotoneaster microphylla* Wall. ex. Lindley.	Spin mamana	Rosaceae	S	D	P	NP	Le
28	*Cynodon dactylon* L. (Pers)	Kabal	Poaceae	H	M	A	GP	Le
29	*Cyperus rotundus* L.	Dela	Cyperaceae	H	M	A	HP	Na
30	*Daphne mucronata* Royle.	Nighoni	Thymelaeaceae	S	D	P	NP	Na
31	*Debregeasia salicifolia* (D Don) Rendle	Aleegi	Urticaceae	S	D	P	TH	Mi
32	*Diospyros kaki* L.	Amluk	Ebenaceae	T	D	P	MP	Mi
33	*Diospyros latus* L.	Persimmon	Ebenaceae	T	D	P	MP	Mi
34	*Dodonea viscosa* L. Jacq	Ghurasky	Sapindaceae	S	D	P	MP	Mi
35	*Dysphonia ambrosioides* L.	Murdar boti	Amaranthaceae	H	D	A	TH	Mi
36	*Equisetum arvense* L.	Horse tail	Equisetaceae	H	Pte	P	GP	Mi
37	*Erigeron somaterinsia* L.	Kharboti	Asteraceae	H	D	A	TH	Mi
38	*Eucalyptus globule* Desh	Lachi	Myrtaceae	T	D	P	MP	Me
39	*Euphorbia helioscopia* L.	Mandaro	Euphorbiaceae	H	D	A	MP	Mi
40	*Ficus carica* L.	Inzar	Moraceae	T	D	P	TH	Na
41	*Fragaria nubicula* (Lindl. Ex Hook.f.) Lacaita	Balmangi	Rosaceae	H	D	P	HP	Mi

42	*Fumaria indica* (Hausskn.) Pugsley	Shatara	Papaveraceae	H	D	A	TH	Na
43	*Galonsoga parviflora* Cav.	Mangoti	Asteraceae	H	D	A	TH	Mi
44	*Gerardiana palmate* (Frossk) Gaudich	Sezona	Urticaceae	H	D	A	TH	Mi
45	*Impatiens bicolor* Royle	Khorboti	Balsaminaceae	H	D	A	TH	Me
46	*Imperata cylindrical* L.	Maloch wakha	Poaceae	H	M	P	TH	Mi
47	*Indigofera heterantha* Wall. Ex Brandis var. heterantha	Ghurigoo	Papilionaceae	S	D	P	NP	Le
48	*Isodon rugosus* Wall. Ex Benth	Krachi-sperka	Lamiaceae	S	D	P	NP	Mi
49	*Jasminum multiflorum* Burm. F.	Gate boti	Oleaceae	S	D	P	NP	Mi
50	*Juglans regia* L.	Ghooz	Juglanolaceae	T	D	P	NP	Mi
51	*Lantana camara* L.	Dergully	Verbenaceae	S	D	P	NP	Mi
52	*Lepidium virginicum* L.	Sharsham like	Brassicaceae	H	D	A	TH	Mi
53	*Lonicera graffiti* Hook.f.&.thoms	Rambir	Caprifoliaceae	S	D	P	TH	Me
54	*Malva neglecta* Wall.	Pandirak	Malvaceae	H	D	A	TH	Mi
55	*Marrubium vulgare* L.	Herohound	Rosaceae	H	D	B	TH	Na
56	*Medicago laciniata* L. Mil	Speshtary	Poaceae	H	D	A	TH	Na
57	*Medicago sativa* L.	Shawtal	Fabaceae	H	D	B	TH	Na
58	*Melia azedarach* L.	Tora shandi	Meliaceae	T	D	P	MP	Mi
59	*Mentha longifolia* (L.) L.	Podina	Lamiaceae	H	D	P	HP	Na
60	*Micromeria biflora* (Buch. Ham. Ex D. Don) Benth	Wild Kashmala	Lamiaceae	H	D	P	TH	Le
61	*Mirabilis jalapa* L.	Japaniz	Nyctaginaceae	H	D	P	GP	Mi
62	*Morus alba* L.	Toortoot	Moraceae	T	D	P	CH	Le
63	*Morus nigra* L.	Spin toot	Moraceae	T	D	P	MP	Me
64	*Narcissus tazetta* L.	Gulingass	Amaryllidaceae	H	M	P	GP	Me
65	*Nastestum officinale* R.Br	Termera	Brassicaceae	H	D	P	TH	Na
66	*Olea ferruginea* Royle L.	Khona	Oleaceae	T	D	P	MP	Mi
67	*Oxalis corniculata* L.	Treewaky	Oxalidaceae	H	D	A	HP	Na
68	*Papaver pavoninum* Schrenk.	Koknar	Papaveraceae	H	D	A	TH	Mi
69	*Parrotiopsis jacquemontiana* Beranj (Don) Rehder.	Branj	Hamamelidaceae	T	D	P	NP	Mi
70	*Parthenium hysterophorus* L.	Parthenium	Asteraceae	H	D	A	TH	Na
71	*Phalaris paradoxa* L.	Peshogi	Poaceae	H	M	A	TH	Na
72	*Pinus gerardiana* Benth	Chalghoza	Pinaceae	T	Gym	P	MP	Na
73	*Pinus roxburgii* Sarg.	Nakhtar	Pinaceae	T	Gym	P	MP	Na
74	*Pinus wallichiana* A.B	Sruf	Pinaceae	T	Gym	P	MP	Na
75	*Plantago lanceolata* L.	Ghugabi	Plantaginaceae	H	D	A	HP	Me
76	*Plantago major* L.	Ghuagabi	Plantaginaceae	H	D	A	HC	Mi
77	*Plantanus orientalous* L.	Chinar	Platanaceae	T	D	P	MP	Me
78	*Polygonum aviculare* L	Bandaka	Polygonaceae	H	M	A	HP	Mi
79	*Populus alba* L.	Supidar	Salicaceae	T	D	P	MP	Mi
80	*Prunus armeniaca* L.	Khubani	Rosaceae	T	D	P	MP	Me
81	*Prunus domestica* L.	Alocha	Rosaceae	T	D	P	MP	Mi
82	*Prunus persica* (L.) Batsch	Shaltaloo	Rosaceae	T	D	P	MP	Mi
83	*Prunus prostrate* L. bill	Elani	Rosaceae	S	D	P	TH	Mi
84	*Punica granatum* L.	Anar	Punicaceae	T	D	P	MP	Na
85	*Pyrus communis* Var	Tango	Rosaceae	T	D	P	MP	Mi

86	*Pyrus peshyia* Ham, ex, D ,Don	Tanga	Rosaceae	T	D	P	MP	Mi
87	*Quercus incana* Roxb	Seri	Fagaceae	T	D	P	MP	Mi
88	*Ranunculus acris* L.	Zirgully	Ranunculaceae	H	D	P	TH	Mi
89	*Ranunculus fluitans* L.	Spinguly	Ranunculaceae	H	D	P	TH	Mi
90	*Ricinus communis* L.	Karkanda	Euphorbiaceae	S	D	P	TH	Mi
91	*Robinia pseudoacacia* L.	Kikar	Papilionaceae	T	D	P	MP	Na
92	*Rosa multiflora* L.	Angargulab	Rosaceae	S	D	P	MP	Mes
93	*Rosa webbiana* Wall Ex Royle	Khurch	Rosaceae	S	D	P	MP	Me
94	*Rubus fruticosus* L.	Bagana	Rosaceae	S	D	P	NP	Me
95	*Rubus ulmifolius* Schott	Bagana	Rosaceae	S	D	P	NP	Me
96	*Rumex hastatus* D.Don	Taroka	Polygonaceae	H	D	A	TH	Mes
97	*Rumex dentatus*	Shalkha	Polygonaceae	H	D	A	TH	Na
98	*Sageretia thea* Osbeck M.C Johnston	Mamana	Rosaceae	S	D	P	NP	Na
99	*Saliva moorcroftiana* Wall ex Benth	Khwarghwag	Lamiaceae	H	D	P	TH	Ma
100	*Salix nigra* L.	Walla	Salicaceae	T	D	P	MP	Mi
101	*Sarcocoa saligna* D. Don Muell. Arg.	Shenwl	Buxaceae	S	D	P	NP	Mi
102	*Silene conoidea* L.	Mangoti	Carophyllaceae	H	D	A	TH	Na
103	*Solanum nigrum* L.	Karmacho	Solanaceae	H	D	A	TH	Mi
104	*Sorghum halepense* Royle	Dadom	Poaceae	H	M	P	TH	Na
105	*Stellaria media* (L.) Hill	Warastalkla	Carophyllaceae	H	M	A	TH	Le
106	*Tagetes minuta* L.	Damargully	Asteraceae	H	M	A	TH	Mi
107	*Taraxacum officinale* (L.) Weber ex F.H.Wigg	Shudapi	Asteraceae	H	D	P	TH	MI
108	*Teucrium stocksianum* Bioss	Doba spin	Lamiaceae	H	D	A	TH	Mi
109	*Thymus lineris* L	Sperki	Lamiaceae	H	D	P	NP	Me
110	*Trachelospermum lucidum* (D. Don) Schum.	Perwati khazana	Apocynaceae	S	D	P	TH	Mi
111	*Tulipa clusiana* D.C	Ghantool	Liliaceae	H	M	P	TH	Na
112	*Urtica dioca* L.	Sezoona	Urticaceae	H	D	B	TH	Mi
113	*Verbascum Thapsus* L	Khardag	Scrophulariaceae	H	D	A	TH	Me
114	*Vicia sativa* L.	Marghahpa	Fabaceae	H	M	A	TH	Na
115	*Viola canescens* Wall .ex. Roxb	Benapsha	Violaceae	H	D	P		Mi
116	*Xanthium strumarium Lour.*	Jeshy	Asteraceae	H	D	A	TP	Mi
117	*Zanthoxylum armanthum* D.C	Dambara	Rutaceae	T	D	P	NP	Mi
118	Ziziphus jujube Mill	Markhani	Rhamnaceae	T	D	P	MP	Mi
119	*Imperata cylindrical* L.	Maloch boti	Poaceae	H	M	A	TH	Na
120	*Galium verrucusum* Royll	Warty bedstraw	Rubiaceae	H	D	A	Tp	Mi
121	*Asplenium Ceterach* L.	Babrozaa	Aspleniaceae	Pte	H	P	G	Mi

Cluster dendrogram

Cluster dendrogram of the 34 sites sampled as show in the (Figure 8). The dendrogram separate the communities into four groups.

Importance value index of the communities

Cluster dendrogram classified the vegetation into 4 meaningful groups. Group I consist of 9 sites, Group II consist of 8 sites, Group III consist of 10 sites, Group 4 consist of 7 sites. The most dominant species is *Imperata cylindrical* in the IVI table, the second dominant specie is the *Indigifera heterantha*. while *Avena fatua* the third dominant specie in the IVI table in the group I. In the second group of the IVI table is

Nastestum officinale dominant and *Anemone tetrasepala* is the second dominant specie while *Diospyros latus* is the third dominant specie. In the third group of the table the *Olea ferruginea* dominant specie while the the second dominant specie is the *Rosa multiflora* while *Avena fatua* is the third dominant specie. In the fourth group of the IVI table the dominant species is the *Cotoneaster nummularia*, is the 1st dominant species and *Polygonum avicularia* is the 2nd dominant *Ajuga parviflora* species while 3rd dominant species is *Cotoneaster nummularia* in the overall table of the IVI it reveals that in the plants community of the Maidan valley (Tables 3, 5 and 7; Figure 9 and 10).

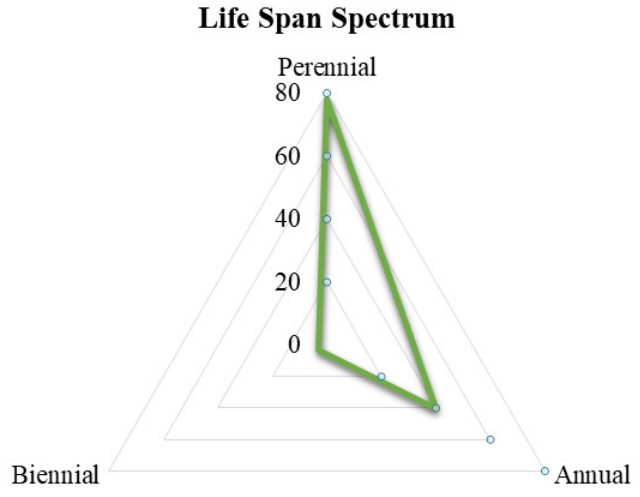

Figure 4: *Life span wise distribution of the vegetation.*

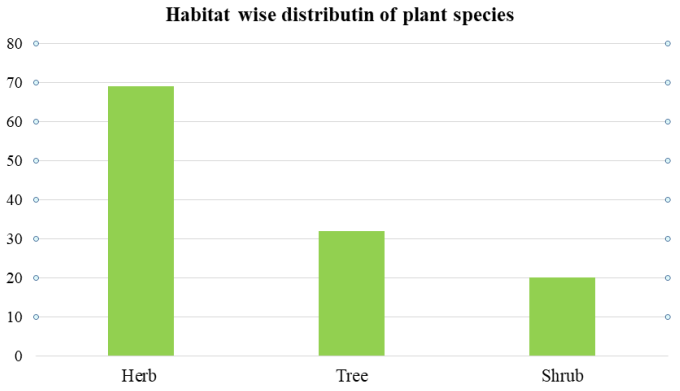

Figure 5: *Habit distribution of the vegetation recorded during the survey.*

Note: SN (Specie Name); Value (Mean ±Standard deviation); _ 0±0 (Absence).

The vegetation data were classified into 4 groups on the basis of environmental factors or variables. These variables are Latitude, Longitude, and Altitude recorded from various sites through Global positioning system (Table 4).

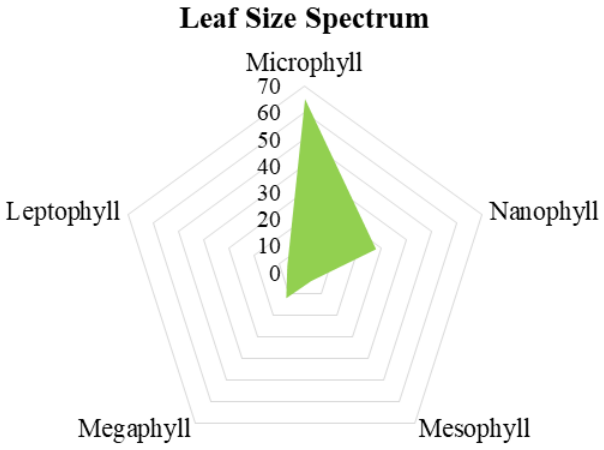

Figure 6: *Leaf size spectrum distribution of the vegetation recorded during the survey.*

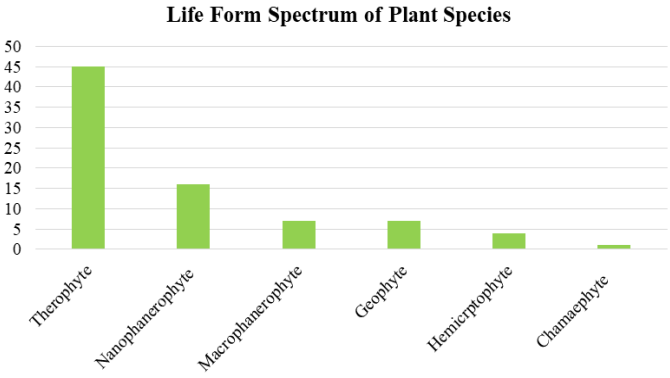

Figure 7: *Life form spectrum of plant species distribution of the vegetation recorded from the study area.*

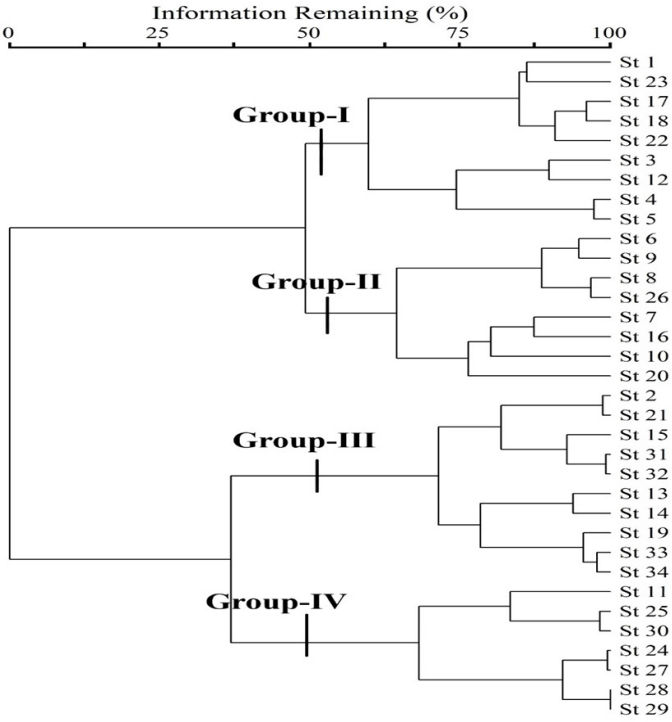

Figure 8: *Cluster dendrogram of sampling sites.*

Table 3: *Importance Value Index (Mean ±Standard deviation) for different vegetation groups identified by cluster analysis.*

Plant Name	Group I	Group II	Group III	Group IV
Alianthus altissima (Mill.) Swingle	4.765 ±2.828	0±0	2.987 ±2.687	5.227 ±5.729
Berberis lyceum L.	5.227 ±5.729	0±0	5.312 ±2.515	0±0
Cannabis sativa L.	0±0	0±0	4.174 ±4.914	3.646 ±2.670
Cynodon dactylon L.(Pers)	2.104 ±3.098	1.820 ±5.150	2.820 ±4.544	14.899 ±6.655
Erigeron somaterinsia L.	3.539 ±2.825	0.968 ±2.738	1.943 ±2.280	3.800 ±2.222
Indigofera heterantha L.	9.908 ±4.516	0.483± 1.367	2.990 ±4.031	0.805 ±2.131
Melia azedarach L.	0.566 ±1.600	0.953± 2.697	2.216 ±3.118	3.388 ±2.358
Micromeria biflora (Buch. Ham)	0.445 ±1.260	0±0	1.304 ±2.131	2.850 ±5.379
Olea ferruginea Royle L.	3.918 ±3.800	1.019 ±2.882	1.432 ±2.371	0.518 ±1.370
Plantago lanceolata L.	1.837 ±3.596	0±0	6.196 ±4.803	3.748 ±4.229
Rosa webbiana Wall Ex Royle	0±0	0.433 ±1.226	1.154 ±2.477	0±0
Rumex dentatus L.	0.843 ±2.386	0±0	5.841 ±5.041	0.954 ±2.525
Salix nigra L.	2.105 ±3.156	0±0	1.394 ±1.809	0.391 ±1.036
Tagetes minuta L.	1.922 ±2.774	1.763 ±4.986	2.503 ±4.162	1.459 ±2.636

Table 4: *Environmental variables as sociated with different vegetation groups sampled in Maidan Valley.*

GPS Value	Group I	Group II	Group III	Group IV
Latitude	3495.34 ±14.70	3463.33 ±15.55	3470.72 ±21.57	3463.25 ±17.05
Longitude	7148.55 ±2.00	7148.72 ±1.75	7147.31 ±2.88	7147.60 ±1.08
Altitude	5902.33 ±895.62	4437.87 ±602.21	4794.1 ±707.97	3723.57 ±936.21

Plant communities

Imperata-Indigofera- Avena (IIA) Community

Imperata cylindrical, Indigifera heterantha and *Avena fatua* community was named based on three dominating species i.e. *Imperata cylindrical, Indigofera heterantha* and *Avena fatua*. The community was observed at the Altitude of 4285 to 7064 feet along the Latitude (3458.849 to 3503.287 N), Longitude (7146.383 to 7151.241 E). This community comprise of 60 species.

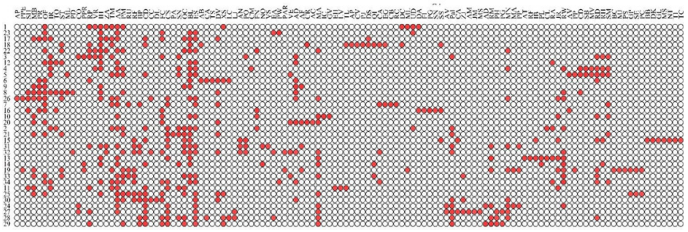

Figure 9: *Showing species presence and absence in different sampled stands, the red color indicate absence while the white color indicate absence in a stand.*

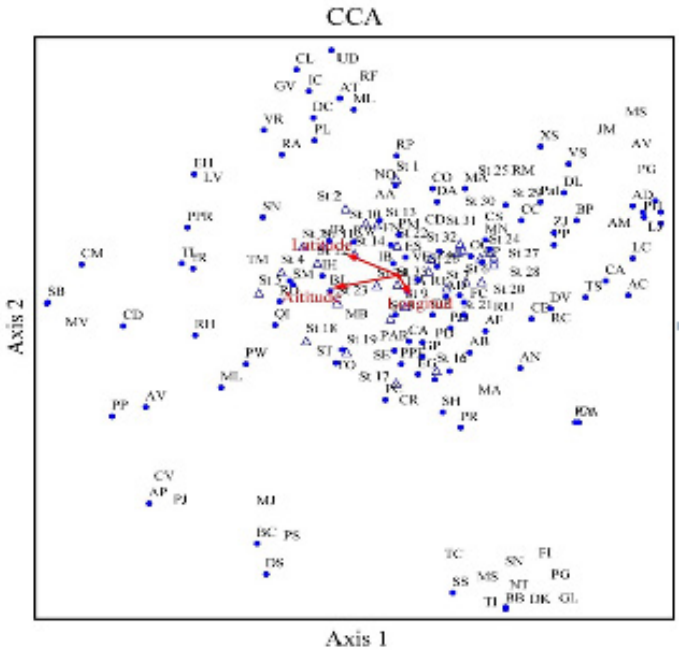

Figure 10: *CCA biplot showing species and stand distribution with effective environmental factors.*

Nastestum-anemone- diospyros (NAD) community

Nastestum-Anemone- Diospyros community was named based on three dominating species i.e. *Nastestum officinale, Anemone tetrasepala*, and *Diospyros latus*. The community was at Altitude of 3781 to 5115 feet along the Latitude (3454.871 to 3501.696 N), Longitude (7145.35 to 7152.206 E). This community comprise of 112 species.

Olea-Rosa-Avena (ORA) community

Olea-Rosa-Avena community was named on three dominating species i.e. *Olea ferruginea*, *Rosa multiflora* and *Avena fatua*. The community was at Altitude of 3555 to 5950 feet along Latitude (3456.875 to 3502.032 N), Longitude (7143.737 to 7152.302 E). This community comprise of 198 species.

Table 5: *Table shows distribution of IVI of vegetation in various groups.*

Scientific name	Group I	Group II	Group III	Group IV
Abies pindrow Royle	0.246±0.697	0.762±2.156	0±0	0±0
Ajuga bracteosa Wall ex Benth.	0.308±0.872	0±0	0±0	0±0
Ajuga perviflora Buch. Ham.	4.765±2.828	2.316±3.559	2.987±2.687	5.227±5.729
Alianthus altissima (Mill.) Swingle	0±0	0±0	1.311±2.174	0±0
Alnus nitida (Spach) Endl.	0±0	0±0	0±0	0.845±1.446
Amaranthus viridis L.	0±0	0±0	0.675±2.136	0±0
Anemone tetrasepala. Royle	1.652±3.092	6.299±7.577	0.597±1.312	0.606±1.604
Aristida adscensionis L.	0±0	0±0	0±0	0.724±1.916
Artimesia meritima L.	1.493±4.224	0.595±1.685	0±0	0±0
Artimesia dubia Wall.	0±0	0±0	0±0	1.895±3.527
Arundo donex L.	0±0	2.135±4.232	0.649±1.503	0±0
Avena fatua L	5.227±5.729	4.122±4.509	5.312±2.515	0±0
Berberis lyceum L.	0±0	0±0	0.273±0.864	0±0
Bergenai ciliate Haw. Sternb	0±0	0.639±1.807	0.726±1.588	2.575±2.598
Broussonetia papyrifera L.	0±0	0±0	0.450±1.426	0±0
Buddleja crispa Benth.	0±0	1.333±2.544	4.174±4.914	3.646±2.670
Cannabus sativa L.	0.602±1.702	0±0	0±0	1.020±1.792
Carthamus oxyacantha M. Bied	2.237±3.891	0.722±1.910	0±0	0±0
Cedrus deodara (Roxb. Ex D.Don	0.412±1.166	0.912±2.580	0.559±1.181	0±0
Celtis australis L.	0±0	0.354±1.001	0.221±0.699	0.606±1.604
Cenchrus ciliaris L.	0±0	0.762±2.156	0±0	0.315±0.833
Chenopodium album L.	0±0	0.632±1.790	0±0	0±0
Chenopodium botrys L.	0.283±0.801	0±0	0±0	0±0
Chloris virgate L.	0±0	0±0	1.314±2.773	0±0
Colchicum luteum Baker	0±0	0±0	0.504±1.595	0.640±1.695
Convolouslus arvensis L.	0.357±1.011	0±0	0±0	0±0
Cotoneaster microphylla Wall.ex.Lindley.	2.104±3.098	0±0	2.820±4.544	14.899±6.655
Cynodan dactylon L.(Pers)	1.101±3.115	1.820±5.150	0±0	0±0
Cyperus rutandus L.	1.449±2.931	0±0	0±0	0±0
Erigeron somaterinsia L.	0.793±1.485	0±0	0±0	0±0
Debregeasia salicifolia (D Don) Rendle	0±0	0±0	0.735±2.326	0±0
Diospyros kaki L.	0±0	0±0	0±0	0.584±1.545
Diospyros latus L.	0.463±1.309	5.277±6.484	1.021±2.177	2.118±3.662
Dodonea viscosa L. Jacq	0.700±1.980	0.515±1.457	0±0	0±0
Dysphonia ambrosioides L.	0.528±1.493	0±0	0.345±1.092	0.315±0.833
Equisetum arvense L.	3.539±2.825	1.961±2.852	1.943±2.280	3.800±2.222
Erigeron somaterinsiaL	0.364±	0.968±2.738	0±0	0±0
Eucalyptus globule Desh	0±0	0±0	0±0	0.616±1.629
Euphorbia helioscopia L.	1.572±2.245	2.092±2.902	0.581±1.226	2.723±2.642
Ficus carica L.	2.039±5.767	1.641±3.198	0.487±1.542	0±0
Fragaria nubicula (Lindl. Ex Hook.f.) Lacaita	0±0	0.423±1.198	0±0	0±0
Fumaria indica (Hausskn.) Pugsley	0±0	0±0	0.231±0.730	0.353±0.936
Galonsoga perviflora Cav.	0±0	0±0	0.267±0.844	0±0
Gerardiana palmate (Frossk) Gaudich	0±0	0±0	0.99501969	0±0
Impatiens bicolor Royle	2.159±4.046	0±0	0±0	0±0

Imperata cylindrical L.	9.908±4.516	2.390±3.301	2.990±4.031	0.805±2.131
Indigofera heterantha Wall. Ex Brandis var.	5.992±7.337	0.483±1.367	0.979±2.162	0.859±2.273
Isodon rugosus Wall. Ex Benth	0±0	0±0	0±0	0.505±1.237
Jasminum multiflorum Burm. F. Andre Andrews.	0±0	1.325±2.523	1.568±2.802	1.026±2.715
Juglans regia L.	0±0	0.672±1.901	0±0	1.270±3.360
Lantana camara L.	0±0	0±0	0±0	0.685±1.812
Lepidium virginicum L.	0±0	0±0	0±0	1.463±2.504
Lonicera graffiti Hook.f.&.thoms	0±0	0±0	0±0	0.470±1.244
Malva sylvestris L.	0.669±1.259	0±0	0±0	0±0
Marrubium vulgare L.	0.882±2.495	0±0	0.315±0.999	0±0
Medicago laciniata L. Mil	0±0	0±0	0.375±1.188	0±0
Malva neglecta Wall.	0.566±1.600	3.361±5.866	2.216±3.118	3.388±2.358
Melia azedarach L.	0.647±1.830	0.953±2.697	0±0	0±0
Mentha longifolia (L.) L.	0.445±1.260	4.541±4.392	1.304±2.131	2.850±5.379
Micromeria biflora (Buch. Ham. Ex D.Don) Benth	0±0	0±0	0.188±0.596	0±0
Mirabilis jalapa L.	0.918±1.720	0.366±1.036	0.859±1.850	2.385±2.414
Morus alba L.	0±0	0±0	0.540±1.709	0.739±1.957
Morus nigra L.	0±0	0±0	0.375±1.188	0±0
Narcissus tazetta L.	0±0	0±0	1.508±3.259	0±0
Nastestum officinale R.Br	3.918±3.800	6.945±3.547	1.432±2.371	0.518±1.370
Olea ferruginea Royle L.	1.837±3.596	1.019±2.882	6.196±4.803	3.748±4.229
Oxalis corniculata L.	0±0	0±0	0.192±0.608	0±0
Papaver pavoninum Schrenk.	0.418±1.182	0±0	0±0	0±0
Parrotiopsis jacquemontiana Beranj (Don) Rehder.	0±0	0±0	0±0	1.646±2.227
Parthenium hysterophorus L.	0±0	0±0	0.413±0.911	0.613±1.623
Phalaris paradoxa L.	0±0	1.168±3.305	0±0	0±0
Pinus gerardiana Benth	0.936±2.649	5.662±5.679	0±0	0±0
Pinus roxburgii Sarg.	2.573±7278	0±0	0.381±1.207	0±0
Pinus wallichiana A.B	0±0	0±0	1.154±2.477	0±0
Plantago lanceolata L.	2.080±2.478	0.433±1.226	2.255±2.477	2.309±3.247
Plantago major L.	0.521±1.475	0±0	1.948±3.321	0±0
Plantanus orientalous L.	0±0	0±0	0.488±1.543	0±0
Polygonum aviculare L.	0.572±1.618	0±0	2.100±2.779	5.261±4.558
Populus alba L.	0±0	0±0	0.549±1.184	0±0
Prunus armeniaca L.	0±0	0.396±1.121	0.218±0689	0±0
Prunus domestica L.	0.549±1.555	0±0	0.316±0.999	0±0
Prunus persica (L.) Batsch	1.764±4.991	0±0	0.892±1.961	0±0
Prunus prostrate L. bill	0±0	0±0	0±0	1.156±1.976
Punica granatum L.	0±0	0±0	0.397±1.256	0.377±0.997
Pyrus communis Var	0±0	0.515±1.457	0.235±0.743	0±0
Pyrus peshyia Ham, ex, D ,Don	0.531±1.504	0±0	1.085±2.307	0±0
Quercus incana Roxb	0.523±1.479	0±0	1.795±2.932	0±0
Ranunculus acris L.	0±0	0±0	0.675±2.136	0±0
Ranunculus fluitans L.	0±0	0.963±2.724	0±0	0±0
Ricinus communis L.	3.547±4.789	0.58±1.536	0.480±1.440	2.850±3.568

Robinia pseudoacacia L.	0±0	0±0	2.091±4.010	2.878±3.881
Rosa multiflora L.	0.843±2.386	1.272±2.356	5.841±5.041	0.954±2.525
Rosa webbiana Wall Ex Royle	0±0	0±0	3.535±3.393	1.807±3.129
Rubus fruticosus L.	0±0	0.885±2.503	0.983±2.161	0.877±2.322
Rubus ulmifolius Schott	2.105±3.156	1.255±2.328	1.394±1.809	0.391±1.036
Rumex hastatus D. Don.	1.201±1.872	0±0	0.683±1.449	0±0
Rumex dentatus L.	1.913±2.790	1.564±3.300	1.129±1.827	0±0
Sageretia thea Osbeck M.C Johnston	1.480±2.188	1.375±2.852	0.626±1.321	0±0
Saliva moorcroftiana Wall ex Benth	1.922±2.774	0±0	2.503±4.162	1.459±2.636
Salix nigra L.	0.418±1.182	1.763±4.986	0.752±2.380	0±0
Sarcocoa saligna D. Don Muell. Arg.	0±0	0±0	0.231±0.730	0.353±0.936
Silene cocoidea L.	0±0	0.515±1.457	0±0	0±0
Solanum nigrum L.	0±0	4.063±6.006	0±0	0.547±1.447
Sorghum halepense Royle	2.883±2.824	1.21±2.096	1.703±3.012	0.799±1.957
Stellaria media (L.) Hill	0.523±1.479	1.295±2.465	0.245±0.776	0±0
Tagetes minuta L.	0±0	0.600±1.699	0±0	0±0
Taraxacum officinale (L.) Weber ex F.H.Wigg	0.289±0.817	0±0	0±0	0.993±2.628
Teucrium stocksianum Bioss	0±0	0±0	0.494±1.564	0±0
Thymus lineris L.	0±0	0±0	0.321±1.016	0±0
Trachelospermum lucidum (D Don) Schum.	1.693±3.592	0±0	0.336±1.064	0±0
Tulipa clusiana D.C	0.296±0.838	0.474±1.343	0.731±1.617	0±0
Urtica dioca L.	0±0	0±0	0.263±0.832	0±0
Verbascum Thapsus L.	1.426±1.609	0±0	0±0	0±0
Vicia sativa L.	0.700±1.980	0.600±1.699	0±0	1.415±1.865
Viola canescens Wall .ex. Roxb	2.252±3.245	0±0	0.880±1.891	0±0
Xanthium strumarium Lour.	0±0	0±0	0.347±1.097	1.279±2.190
Zanthoxylum armanthum D.C	0±0	2.326±6.581	0±0	0±0
Ziziphus jujube Mill	0±0	1.238±3.503	0±0	0±0
Imperata cylindrical L.	0±0	0.426±1.207	0±0	0±0
Galium verrucusum Royle	0.880±1.891	0±0	0.543±2.094	2.342±1.564
Asplenium ceterach L.	0±0	4.732±5.143	0±0	4.213±3.312

Cotoneaster- Polygonum- Ajuga (CPA) community

Cotoneaster- Polygonum- Ajuga community was named on the basis of three dominant species i.e *Cotoneaster nummularia, Polygonum avculare, Ajuga pervflora.* The community was at Altitude of 3205 to 5811 feet along Latitude (3456.069 to 3501.887 N), Longitude (7146.071 to 7149.06 E). This community is comprised of 122 species (Table 6 and 8; Figure 9 and 10).

Discussion

Mountains are the major ecosystem show the interrelated and complex ecology of our plants. The study area was rich in vegetation. A total of 121 species belonging to 62 families and 108 genera were identified and studied out of 62 families. The Dominant family was Rosaceae have 14 species, followed by Poaceae with 11 species, Asteraceae with 10 species, Lamiaceae with 9 species. Similar finding was recorded by (Shaheen *et al*., 2011) who studied the phytodiversity and endemic richness in high altitude Rama Valley and reported total of 83 species belonging to 31 families from the area. The plant habit showed that the herb with 57% are dominant in all communities, trees with 26%, the shrub with 17 % are very less as compare to all other plants in all communities. Our results are similar with (Gul et al., 2025) who worked on phytodiversity of some useful plants. According to (Gul et al., 2025), herbs were the most commonly used lifeform by the local inhabitants represents 86 plant species. According to their plant life span perennial are dominant with 74%, annual

Table 6. *Table showing axis summary, correlation and biplot scores of the environmental variables effecting the reported communities.*

Axis		**Axis 1**	**Axis 2**	**Axis 3**
Eigenvalue		0.364	0.286	0.231
	Variance in species data			
% of variance explained		5.2	4.1	3.3
Cumulative % explained		5.2	9.2	12.5
Pearson Correlation, Spp-Envt*		0.961	0.862	0.86
Kendall (Rank) Corr., Spp-Envt		0.854	0.654	0.693
Variable	Correlation Axis 1 Axis 2 Axis 3	Biplot scores		
		Axis 1 Axis 2 Axis 3		
Altitude	-0.96 -0.268 -0.076	-0.58 -0.143 -0.037		
Latitude	-0.775 0.448 -0.445	-0.468 0.24 -0.214		
Longitude	0.175 -0.384 -0.907	0.105 -0.205 -0.436		

Table 7: *Table shows communities of the vegetation in various groups on basis of IVI values.*

No of species	**60**	**112**	**198**	**122**
N	3495.34±14.70	3463.33±15.55	3470.72±21.57	3463.25±17.05
E	7148.55±2.00	7148.72±1.75	7147.31±2.88	7147.60±1.08
Hz	5902.33±895.62	4437.87±602.21	4794.1±707.97	3723.57±936.21

with 25% and biennial are 1%. Similar results were reported by (Qureshi *et al.,* 2014), they worked on phytodiversity and plant life of Khanpur Dam, Khyber Pakhtunkhwa, Pakistan and stated that most of the taxa were perennials (49.32%) followed by annuals (47.51%) and biennial (3.17%). The result conclude that dicot is 79%, Monocot 15%, gymnosperm 4 and pteridophytes 2% respectively. Similar studies were conducted by (Sher *et al*., 2011) who worked on Floristic composition, communities and ecological characteristics of weeds of wheat fields of Lahore, District Swabi, Pakistan. By using Raunkiaer life form the result suggest that the dominant life form was Macrophanerophyte 9%, Therophyte with 65%, Nanophanerophyte with 20%, Geophyte with 9%, Hemicrptophyte with 5% and Chamaephyte with 1%. The present findings are in agreement with (Barik and Misra 1998), they worked on Kaumaun Himalaya and grassland ecosystem of south Orissa, they reported that Therophyte were dominant followed by Chamaephytes and Hemicryptophytes. The result indicated that the dominant Leaf size was Microphyll with 56%, Nanophyll 24%, Mesophyll 4%, Megaphyll 10% and Leptophyll 6%. Our results are similar with (Parveen *et al.,* 2021) who worked on phytodiversity and ethnobotanical features of plants of Shahbaz Garhi Mardan, Khyber Pakhtunkhwa, Pakistan who listed that the leaf size spectra showed that Microphylls was dominant with 25 spp. (29.4 %), followed by Mesophylls with 24 spp. (28.2 %), while the Nanophylls with 12 spp. (14.1%) and Leptophyll with 10 spp. (11.7 %). Vegetation structure of Maidan valley dir lower shows that the total of 4 communities was established using IVI distribution.

Conclusions and Recommendations

The present study was conducted to document and analyze the phytodiversity of Maidan Valley in Tehsil Lal Qilla, Lower Dir, Khyber Pakhtunkhwa, Pakistan. The results revealed that the area possesses rich plant diversity, with a total of 121 plant species belonging to 108 genera and 62 families. Among the recorded families, Rosaceae was the dominant family with 14 species. The vegetation was mainly dominated by dicotyledonous plants, with herbs and trees representing the major growth forms. Based on life span, the flora comprised 40 annual species, 78 perennial species, and 3 biennial species. Life form analysis showed the dominance of therophytes (45 species), followed by nanophanerophytes (16 species), macrophanerophytes (7 species), Hemicryptophytes (4 species), Chamaephytes (1 species), and geophytes (7 species). The leaf size spectrum indicated that microphylls were the most abundant (65 species), followed by Nanophylls (28 species), mesophylls (4 species),

Table 8: *Ecological Indices of recorded plant species form the study area.*

Plant Name	IIA	NAD	ORA	CPA
Abies pindrow Rolye.	0.246±0.697	0.762±2.156	0±0	0±0
Ajuga bracteosa Wall ex Benth.	0.308±0.872	0±0	0±0	0±0
Ajuga perviflora Buch. Ham.	4.765±2.828	2.316±3.559	2.987±2.687	5.227±5.729
Alianthus altissima (Mill.) Swingle	0±0	0±0	1.311±2.174	0±0
Alnus nitida (Spach) Endl.	0±0	0±0	0±0	0.845±1.446
Amaranthus viridis L.	0±0	0±0	0.675±2.136	0±0
Anemone tetrasepala. Royle	1.652±3.092	6.299±7.577	0.597±1.312	0.606±1.604
Aristida adscensionis L.	0±0	0±0	0±0	0.724±1.916
Artimesia meritima L.	1.493±4.224	0.595±1.685	0±0	0±0
Artimesia dubia Wall.	0±0	0±0	0±0	1.895±3.527
Arundo donex L.	0±0	2.135±4.232	0.649±1.503	0±0
Avena fatua L	5.227±5.729	4.122±4.509	5.312±2.515	0±0
Berberis lyceum L.	0±0	0±0	0.273±0.864	0±0
Bergenia ciliate Haw. Sternb	0±0	0.639±1.807	0.726±1.588	2.575±2.598
Broussonetia papyrifera L.	0±0	0±0	0.450±1.426	0±0
Buddleja crispa Benth.	0±0	1.333±2.544	4.174±4.914	3.646±2.670
Cannabis sativa L.	0.602±1.702	0±0	0±0	1.020±1.792
Carthamus oxycantha M. Bied	2.237±3.891	0.722±1.910	0±0	0±0
Cedrus deodara (Roxb. Ex D.Don	0.412±1.166	0.912±2.580	0.559±1.181	0±0
Celtis australis L.	0±0	0.354±1.001	0.221±0.699	0.606±1.604
Cenchrus ciliaris L.	0±0	0.762±2.156	0±0	0.315±0.833
Chenopodium album L.	0±0	0.632±1.790	0±0	0±0
Chenopodium botrys L	0.283±0.801	0±0	0±0	0±0
Chloris virgate L.	0±0	0±0	1.314±2.773	0±0
Colchicum luteum Baker	0±0	0±0	0.504±1.595	0.640±1.695
Convolvulus arvensis L	0.357±1.011	0±0	0±0	0±0
Cotoneaster microphylla Wall. ex. Lindley.	2.104±3.098	0±0	2.820±4.544	14.899±6.655
Cynodon dactylon L.(Pers)	1.101±3.115	1.820±5.150	0±0	0±0
Cyperus rotundus L.	1.449±2.931	0±0	0±0	0±0
Daphne mucronata Royle.	0.793±1.485	0±0	0±0	0±0
Debregeasia salicifolia (D Don) Rendle	0±0	0±0	0.735±2.326	0±0
Diospyros kaki L.	0±0	0±0	0±0	0.584±1.545
Diospyros latus L.	0.463±1.309	5.277±6.484	1.021±2.177	2.118±3.662
Dodonea viscosa L. Jacq	0.700±1.980	0.515±1.457	0±0	0±0
Dysphonia ambrosioides L.	0.528±1.493	0±0	0.345±1.092	0.315±0.833
Equisetum arvense L.	3.539±2.825	1.961±2.852	1.943±2.280	3.800±2.222
Erigeron somaterinsiaL	0.364±	0.968±2.738	0±0	0±0
Eucalyptus globule Desh	0±0	0±0	0±0	0.616±1.629
Euphorbia helioscopia L.	1.572±2.245	2.092±2.902	0.581±1.226	2.723±2.642
Ficus carica L.	2.039±5.767	1.641±3.198	0.487±1.542	0±0
Fragaria nubicula (Lindl. Ex Hook.f.) Lacaita	0±0	0.423±1.198	0±0	0±0
Fumaria indica (Hausskn.) Pugsley	0±0	0±0	0.231±0.730	0.353±0.936
Galonsoga perviflora Cav.	0±0	0±0	0.267±0.844	0±0
Gerardiana palmate (Frossk) Gaudich	0±0	0±0	0.99501969	0±0
Impatiens bicolor Royle	2.159±4.046	0±0	0±0	0±0
Imperata cylindrical L.	9.908±4.516	2.390±3.301	2.990±4.031	0.805±2.131

Indigofera heterantha Wall. Ex Brandis var. heterantha Brandis var. heterantha	5.992±7.337	0.483±1.367	0.979±2.162	0.859±2.273
Isodon rugosus Wall. Ex Benth	0±0	0±0	0±0	0.505±1.237
Jasminum multiflorum Burm. F. Andrews.	0±0	1.325±2.523	1.568±2.802	1.026±2.715
Juglans regia L.	0±0	0.672±1.901	0±0	1.270±3.360
Lantana camara L.	0±0	0±0	0±0	0.685±1.812
Lepidium virginicum L.	0±0	0±0	0±0	1.463±2.504
Lonicera graffiti Hook.f.&.thoms	0±0	0±0	0±0	0.470±1.244
Malva neglecta Wall.	0.669±1.259	0±0	0±0	0±0
Marrubium vulgare L.	0.882±2.495	0±0	0.315±0.999	0±0
Medicago laciniata L. Mil	0±0	0±0	0.375±1.188	0±0
Medicago sativa L	0.566±1.600	3.361±5.866	2.216±3.118	3.388±2.358
Melia azedarach L	0.647±1.830	0.953±2.697	0±0	0±0
Mentha longifolia (L.) L.	0.445±1.260	4.541±4.392	1.304±2.131	2.850±5.379
Micromeria biflora (Buch. Ham. Ex don) Benth	0±0	0±0	0.188±0.596	0±0
Mirabilis jalapa L.	0.918±1.720	0.366±1.036	0.859±1.850	2.385±2.414
Morus alba L.	0±0	0±0	0.540±1.709	0.739±1.957
Morus nigra L.	0±0	0±0	0.375±1.188	0±0
Narcissus tazetta L.	0±0	0±0	1.508±3.259	0±0
Nastestum officinale R.Br	3.918±3.800	6.945±3.547	1.432±2.371	0.518±1.370
Olea ferruginea Royle L.	1.837±3.596	1.019±2.882	6.196±4.803	3.748±4.229
Oxalis corniculata L.	0±0	0±0	0.192±0.608	0±0
Papaver pavoninum Schrenk.	0.418±1.182	0±0	0±0	0±0
Parrotiopsis jacquemontiana Beranj (Don) Rehder.	0±0	0±0	0±0	1.646±2.227
Parthenium hysterophorus L.	0±0	0±0	0.413±0.911	0.613±1.623
Phalaris paradoxa L	0±0	1.168±3.305	0±0	0±0
Pinus gerardiana Benth	0.936±2.649	5.662±5.679	0±0	0±0
Pinus roxburgii Sarg.	2.573±7278	0±0	0.381±1.207	0±0
Pinus wallichiana A.B	0±0	0±0	1.154±2.477	0±0
Plantago lanceolata L.	2.080±2.478	0.433±1.226	2.255±2.477	2.309±3.247
Plantago major L.	0.521±1.475	0±0	1.948±3.321	0±0
Plantanus orientalous L.	0±0	0±0	0.488±1.543	0±0
Polygonum aviculare L	0.572±1.618	0±0	2.100±2.779	5.261±4.558
Populus alba L.	0±0	0±0	0.549±1.184	0±0
Prunus armeniaca L.	0±0	0.396±1.121	0.218±0689	0±0
Prunus domestica L.	0.549±1.555	0±0	0.316±0.999	0±0
Prunus persica (L.) Batsch	1.764±4.991	0±0	0.892±1.961	0±0
Prunus prostrate L bill	0±0	0±0	0±0	1.156±1.976
Punica granatum L	0±0	0±0	0.397±1.256	0.377±0.997
Pyrus communis Var	0±0	0.515±1.457	0.235±0.743	0±0
Pyrus peshyia Ham, ex, D ,Don	0.531±1.504	0±0	1.085±2.307	0±0
Quercus incana Roxb	0.523±1.479	0±0	1.795±2.932	0±0
Ranunculus acris L	0±0	0±0	0.675±2.136	0±0
Ranunculus fluitans L.	0±0	0.963±2.724	0±0	0±0
Ricinus communis L.	3.547±4.789	0.58±1.536	0.480±1.440	2.850±3.568
Robinia pseudoacacia L.	0±0	0±0	2.091±4.010	2.878±3.881

Rosa multiflora L.	0.843±2.386	1.272±2.356	5.841±5.041	0.954±2.525
Rosa webbiana Wall Ex Royle	0±0	0±0	3.535±3.393	1.807±3.129
Rubus fruticosus L.	0±0	0.885±2.503	0.983±2.161	0.877±2.322
Rubus ulmifolius Schott	2.105±3.156	1.255±2.328	1.394±1.809	0.391±1.036
Rumex hastatus D.Don	1.201±1.872	0±0	0.683±1.449	0±0
Rumex dentatus L.	1.913±2.790	1.564±3.300	1.129±1.827	0±0
Sageretia thea Osbeck M.C Johnston	1.480±2.188	1.375±2.852	0.626±1.321	0±0
Saliva moorcroftiana Wall ex Benth Ben	1.922±2.774	0±0	2.503±4.162	1.459±2.636
Salix nigra L.	0.418±1.182	1.763±4.986	0.752±2.380	0±0
Sarcocoa saligna D. Don Muell. Arg.	0±0	0±0	0.231±0.730	0.353±0.936
Silene cocoidea L.	0±0	0.515±1.457	0±0	0±0
Solanum nigrum L.	0±0	4.063±6.006	0±0	0.547±1.447
Sorghum halepense Royll	2.883±2.824	1.21±2.096	1.703±3.012	0.799±1.957
Stellaria media (L.) Hill	0.523±1.479	1.295±2.465	0.245±0.776	0±0
Tagetes minuta L.	0±0	0.600±1.699	0±0	0±0
Taraxacum officinale (L.) Weber ex F.H.Wigg	0.289±0.817	0±0	0±0	0.993±2.628
Teucrium stocksianum Bioss	0±0	0±0	0.494±1.564	0±0
Thymus lineris L.	0±0	0±0	0.321±1.016	0±0
Trachelospermum lucidum (D. Don) Schum.	1.693±3.592	0±0	0.336±1.064	0±0
Tulipa clusiana D.C	0.296±0.838	0.474±1.343	0.731±1.617	0±0
Urtica dioca L.	0±0	0±0	0.263±0.832	0±0
Verbascum Thapsus L.	1.426±1.609	0±0	0±0	0±0
Vicia sativa L.	0.700±1.980	0.600±1.699	0±0	1.415±1.865
Viola canescens Wall .ex. Roxb	2.252±3.245	0±0	0.880±1.891	0±0
Xanthium strumarium Lour.	0±0	0±0	0.347±1.097	1.279±2.190
Zanthoxylum armanthum D.C	0±0	2.326±6.581	0±0	0±0
Ziziphus jujube Mill	0±0	1.238±3.503	0±0	0±0
Imperata cylindrical L.	0±0	0.426±1.207	0±0	0±0
Galium verrucusum Royle	0.880±1.891	0±0	0.543±2.094	2.342±1.564
Asplenium ceterach L.	0±0	4.732±5.143	0±0	4.213±3.312

Megaphyll (12 species), and Leptophyll (7 species). The study highlights that the vegetation of Maidan Valley reflects specific ecological adaptations to the local climatic and environmental conditions. In addition, many plant species are utilized by local communities for medicinal, fuel, fodder, and other traditional purposes, indicating their socio-economic importance. Therefore, the findings emphasize the need for proper conservation and sustainable management of plant resources in the region to preserve biodiversity and maintain ecological balance. This baseline information will be valuable for future ecological studies, biodiversity conservation planning, and sustainable utilization of plant resources in the area.

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Novelty Statement

This study provides the first comprehensive phytodiversity assessment of Maidan Valley in Lower Dir, documenting plant species composition, distribution patterns, and ecological characteristics in a previously underexplored region. It generates baseline data essential for conservation planning and sustainable utilization of plant resources in Khyber Pakhtunkhwa.

Author's Contribution

Ashfaq Mujahid Khan, Imran Ahmad and Huma Gul: Collected and analyzed the data.
Syeda Ume Rubab, Zakir Ullah, Morlai Sesay, Waqas Ahmed, Farid Ullah and Muhammad Umar Farooq: Wrote the text.
Huma Gul: Wrote the final version of the text.
All authors approved the final version of the manuscript.

Generative AI and AI-assisted technology statement
The authors declare that no generative AI and AI assisted technology was used in the creation of this Manuscript.

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