



Floristic evaluation and ecological attributes of plants resources of Mandan, district Bannu, Pakistan

Taj Yousaf Khan¹, Lal Badshah², Shariat Ullah³, Asghar Ali⁴

^{1, 2, 4} Phytoecology lab. Department of Botany University of Peshawar, Pakistan

³ University of Malakand Chakdara, Dir lower, Pakistan

⁴ Govt AKL Post Graduate College Matta, Swat, Pakistan

Abstract

Present study was conducted to assess the floristic composition of Mandan, District Bannu during 2015-16. The floristic diversity comprised of 99 species belonging to 37 families. Based on species diversity, Poaceae and Solanaceae were represented by 9 species each followed by Asteraceae and Fabaceae with 8 species each. Brassicaceae with 6 species and Papilionaceae with 5 species were the next diverse families of flowering plants while Apiaceae and Euphorbiaceae each had 4 species. Biological spectrum revealed that therophytes were the dominant life form with 54 species (54.54%) followed by micro-phenophytes represented by 16 species (16.16%). Hemi cryptophytes with 10 species (10.10%) and geophytes with 8 species (8.08%) were next important life forms. The leaf size spectrum revealed that Nanophylls with 30 species (30.30%) and Microphylls with 25 species (25.25%) were dominating the landscape. Mesophylls with 21 species (21.21%), Leptophylls with 19 species (19.19%) and Megaphylls with 4 species (4.04%) were also recorded from the research area. Several factors including anthropogenic impact, over exploitation and soil erosion are a constant threat to local flora.

Keywords: Flora, Biological spectrum, Life form, Habitat, Bannu

1. Introduction

Bannu is an ancient city, its present location was selected by Sir Herbert Edwardes in 1848. After his name it was once called *Edwardes Abad* and later as *Dalipnagar*. Bannu, Bana, or BaniGul, (as pronounced by the locals) was an important road junction and market city. It is situated in the South of Peshawar and Kohat at nearly 118 miles and 79 miles respectively, it is at 89 miles to the north of Dera Ismail Khan. District Bannu, contains an area of 1,227 km² lying North of the Mighty Indus (Fig: 1). Majority of the population still live in villages. The climate of the study area is semi-arid with hot and dry summers and moderate cool winters. The temperatures are highest on average in June, at around 33.6°C. January is the coldest month, with temperature averaging 11.7°C. The research area Mandan is one of the prominent areas of Bannu. It is situated adjacent to the main city.

2. Materials and Method

The study was conducted during winter season 2015 and spring season 2016. Plants were collected from different parts of research area. Plants were dried, preserved and mounted on the standard herbarium sheets. Plants were identified with the help of Flora of Pakistan [13, 1]. Plant specimens were deposited at Herbarium of Department of Botany, University of Peshawar. A complete checklist of species along with families and ecological descriptions was prepared. Plants were classified into life form and leaf size classes following Badshah *et al.* 2013. [5]. Biological spectrum and leaf size classes were determined following

Raunkiaer; Ali *et. al.* [15, 2].

3. Results

3.1 Floristics Composition

Flora of a region is the sum of all plant species within its ecological boundaries, both wild as well as cultivated, and it is the reflection of vegetation and plants resources. Plants communities are influenced by agriculture, overgrazing, anthropogenic pressures and natural calamities. The flora of Mandan area consisted of 99 species belonging to 37 families. Out of these, 33 families were of Dicotyledons while 4 families were of Monocotyledons (Table.1). Poaceae and Asteraceae were the dominant families with 9 and 8 species respectively, followed by Fabaceae and Solanaceae with 8 species and 9 respectively. Brassicaceae and Papilionaceae were represented by 6 and 5 species respectively. Euphorbiaceae and Apiaceae had 4 species each. Chenopodiaceae, Cucurbitaceae, Moraceae, Plantigonaceae, Rutaceae and Zygophyllaceae each had 3 species. Alliaceae, Mimosaceae, Lamiaceae, Polygonaceae and Rhamnaceae had 2 species each. (Table.1).

3.2 Life Form

Based on life form Therophytes dominated with 54 species (55.54%) followed by Microphenophytes (16 species, 16.16%), Hemicryptophytes (10 species, 10.10%) and Geophytes (8 species, 8.08%). Chamaephytes were represented by 6 species (6.06%) and Nanophanerophytes with 5 species (5.05%, Fig: 2).

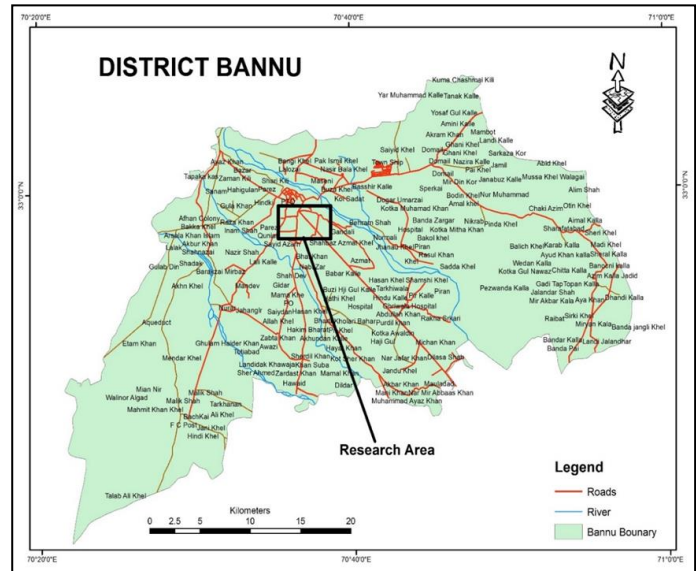


Fig 1: Map of research Area

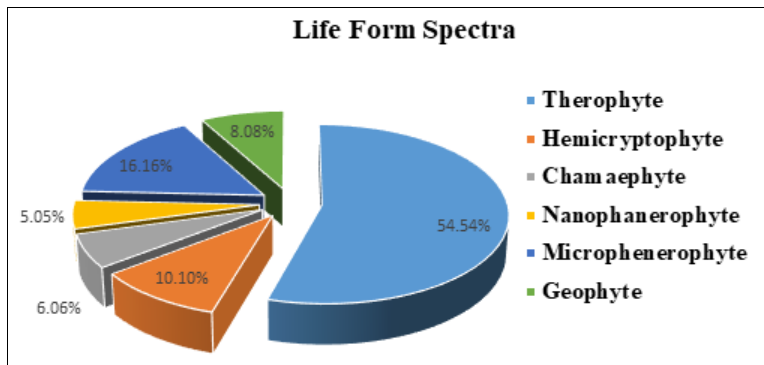


Fig 2: Life form Spectra

3.4 Leaf Size Spectra

The overall leaf size spectrum of the region was dominated by Nanophylls with 30 species (30.30%) followed by

Microphylls with 25 species (25.25%), Mesophylls 21 species (21.21%) and Leptophylls 19 species (19.19%) and Megaphylls having 4 species (4.04%), given in (Fig. 3).

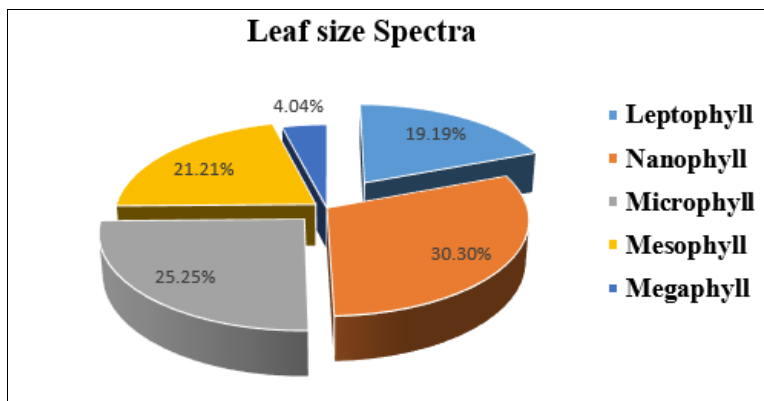


Fig 3: Leaf Size Spectra

4. Discussions

4.1 Floristics Composition

It has been reported that flora of Harboi rangeland, Kalat, Balochistan also showed Asteraceae, Papilionaceae and Poaceae as dominant families [7]. Asteraceae, Brassicaceae, Poaceae and Solanaceae were leading families in vegetation of Hayatabad, Peshawar [17]. The vegetation analysis in Hail region of Saudi Arabia revealed that Asteraceae had highest

species diversity followed by Poaceae and Brassicaceae [8]. Our findings are strongly supported by these works as Asteraceae and Poaceae appeared as the leading families in their study areas. Similarly, other floristic studies from Pakistan as well as abroad also reported Asteraceae as a dominant family [11, 14, 4, 5, 3]. Our results are in line with most of the above-mentioned studies from Pakistan as well as abroad.

4.2 Life Form

The floristic study of Harboi rangeland (Kalat, Balochistan) concluded that the dominant life forms were therophytes [7]. This is also in accordance with the present study. Phytosociological study of vegetation of Hayatabad, Peshawar also revealed that therophytes were the dominant class, strongly supporting our findings [17]. While the vegetation analysis in Hail region Saudi Arabia, recording therophytes and chamaephytes as dominant life forms, supporting the present study [8]. Similarly, the floristic studies from different regions also in line with the present study [11, 10, 3, 16, 18, 5, 6 and 12].

4.3 Leaf Size Spectra

The field study of University of Peshawar Botanical Garden concluded that Nanophylls were the major leaf size class followed by Microphylls, Leptophylls and Mesophylls [9]. The leaf size spectra of Ganga Chotti and Bedori Hills reporting Nanophylls and Microphylls as dominant leaf size classes in spring and monsoon seasons [12]. Likewise, different researchers also reported the Nanophylls as dominant leaf size class from different regions. [10, 7, 2]. The research area is under severe grazing pressure, deforestation in addition to soil and wind erosion. Low

species diversity in the research area is mostly due to overgrazing, soil erosion, deforestation and dry existing environmental conditions. In open plant life, sun loving or tolerant species, which require low moisture, low humidity might do improved. In investigated sites few species can compete and complete their life cycle while, those, which necessitate healthier habitat in terms of shade, light and moisture are usually excluded. This reduced the species diversity as number of sociophytes reduced.

5. Recommendations

1. Management of moderate and rotational grazing be enforced to reduce the regeneration of primary producer (vegetation).
2. There is a need to promote principles for conservation and development of natural vegetation, soil and land management. Due to low vegetation cover soil is being eroded very fast.
3. Linkages among regional, sub-regional and international research and developmental programs should be required for appliance and management plans so that socioeconomic and ecological conditions could be appropriately addressed.

Table1: Floristic composition, biological spectrum, leaf size spectrum and Habitats of plants of Mandan, District Bannu.

S.No	Taxon	Local name	Voucher No	Life form	Leaf Size	Habitat
Division Monocotyledonae						
Family Aliaceae						
1	<i>Allium cepa</i> L.	Piyaz	Taj.Y.Bot 01 (PUP)	G	N	CU
2	<i>Allium sativum</i> L.	Oga	Taj.Y.Bot 02 (PUP)	G	N	CU
Family Arecaceae						
3	<i>Phoenix dactylifera</i> L.	Khajira	Taj.Y.Bot 03 (PUP)	MP	Mes	W-D
Family Asparagaceae						
4	<i>Asparagus gracilus</i> Royle.	Sataver	Taj.Y.Bot 04 (PUP)	Ch	L	D-WP
Family Poacea						
5	<i>Cynodon dactylon</i> (L.) Pers	Baruwa	Taj.Y.Bot 05 (PUP)	H	L	D-A
6	<i>Dichanthium annulatum</i> (Forssk.) stapf	Waha	Taj.Y.Bot 06 (PUP)	H	N	GY-A
7	<i>Hordeum vulgare</i> L.	Arbsha	Taj.Y.Bot 07 (PUP)	H	Mic	CU-A
8	<i>Oryza sativa</i> L.	Vreza	Taj.Y.Bot 08 (PUP)	Th	Mic	CU
9	<i>Poa annua</i> L.	Grass	Taj.Y.Bot 09 (PUP)	Th	L	D
10	<i>Saccharum officinarum</i> L.	Gana	Taj.Y.Bot 10 (PUP)	Th	Mes	CU
11	<i>Triticum aestivum</i> L.	Ghanum	Taj.Y.Bot 11 (PUP)	Th	Mic	CU
12	<i>Zea mays</i> L.	Jawar	Taj.Y.Bot 12 (PUP)	Th	Mes	CU
13	<i>Avena sativa</i> L.	Jawdar	Taj.Y.Bot 13 (PUP)	Th	Mic	D
Division Dicotyledonae						
Family Amaranthaceae						
14	<i>Amaranthus viridis</i> L.	Jeshy	Taj.Y.Bot 14 (PUP)	Th	N	D
Family Asclepiadiaceae						
15	<i>Calotropis procera</i> W. T Aiton	Spalmaka	Taj.Y.Bot 15 (PUP)	Ch	Mes	D
Family Apiaceae						
16	<i>Foeniculum vulgare</i> . Mill.	Sop	Taj.Y.Bot 16 (PUP)	Th	L	A
17	<i>Coriandrum sativum</i> L.	Dhanya	Taj.Y.Bot 17 (PUP)	H	N	CU
18	<i>Ammi visnaga</i> L.	Sparkai	Taj.Y.Bot 18 (PUP)	Th	L	D-A
19	<i>Daucus carota</i> L.	Kajara	Taj.Y.Bot 19 (PUP)	G	Mes	CU
Family Asteraceae						
20	<i>Cirsium arvense</i> (L.) Scop	Azghikai	Taj.Y.Bot 20 (PUP)	Th	Mic	D
21	<i>Conyza canadensis</i> (L.) Cronquist	Kharbita	Taj.Y.Bot 21 (PUP)	Th	Mic	WP
22	<i>Helianthus annuus</i> L.	Suraj muki	Taj.Y.Bot 22 (PUP)	Th	Mes	CU
23	<i>Parthenium hysterophorus</i> L.	Khsbuty	Taj.Y.Bot 23 (PUP)	Th	Mes	A-D
24	<i>Taraxicum officinale</i> F. H. Wigg	Shoudapay	Taj.Y.Bot 24 (PUP)	Th	Mic	D
25	<i>Xanthium strumarium</i> L.	Barbaka	Taj.Y.Bot 25 (PUP)	Th	N	WP
26	<i>Lactuca sativa</i> L.	Salad	Taj.Y.Bot 26 (PUP)	Th	Mic	CU
27	<i>Centaurea iberica</i> Trevir. Ex Spreng.	Azghakai	Taj.Y.Bot 27 (PUP)	Th	N	WP
Family Brassicaceae						

28	<i>Brassica compestres</i> L.	Sarsoo	Taj. Y. Bot 28 (PUP)	Th	Mes	CU
29	<i>Brassica oleracea</i> Var. <i>botrytis</i> L.	Band ghi	Taj. Y. Bot 29 (PUP)	Th	Mic	CU
30	<i>Raphanus sativus</i> L.	Mouli	Taj. Y. Bot 30 (PUP)	Th	Mic	CU
31	<i>Lepidium sativum</i> L.	Waha	Taj. Y. Bot 31 (PUP)	Th	Mes	WP
32	<i>Coronopus didymus</i> (L.) Pers.	Waha	Taj. Y. Bot 32 (PUP)	Th	L	WP
33	<i>Brassica rapa</i> L.	Wild sarsoo	Taj. Y. Bot 33 (PUP)	Th	N	CU
Family Cactaceae						
34	<i>Opuntia dillenii</i> How	Zakum	Taj. Y. Bot 34 (PUP)	Np	L	D
Family Cannabaceae						
35	<i>Cannabis sativa</i> L.	Bhang	Taj. Y. Bot 35 (PUP)	Th	Mic	WP
Family Caryophyllaceae						
36	<i>Stellaria media</i> (L.) Vill	Carvachi	Taj. Y. Bot 36 (PUP)	Th	N	M
Family Chenopodiaceae						
37	<i>Chenopodium murale</i> L.	Sakh boti	Taj. Y. Bot 37 (PUP)	Th	L	D
38	<i>Spinacia oleracea</i> L.	Salad	Taj. Y. Bot 38 (PUP)	Ch	Mes	CU
39	<i>Chenopodium album</i> L.	Sakh boti	Taj. Y. Bot 39 (PUP)	Th	Mic	A
Family Convolvulaceae						
40	<i>Convolvulus arvensis</i> L.	Parwaty	Taj. Y. Bot 40 (PUP)	Th	N	F-A
Family Cucurbitaceae						
41	<i>Lagenaria siceraria</i> (Molina) Standl.	Ground	Taj. Y. Bot 41 (PUP)	Th	Mg	A
42	<i>Luffa cylindrica</i> (L.) Roem.	Toori	Taj. Y. Bot 42 (PUP)	Th	Mg	CU
43	<i>Cucurbita pepo</i> L.	Kado	Taj. Y. Bot 43 (PUP)	Th	Mg	CU
Family Euphorbiaceae						
44	<i>Euphorbia hirta</i> L.	Wermagu	Taj. Y. Bot 44 (PUP)	Th	L	A-D
45	<i>Euphorbia prostrata</i> Aiton	Wermagu	Taj. Y. Bot 45 (PUP)	Ch	Mes	A-D
46	<i>Racinus communis</i> L.	Arand	Taj. Y. Bot 46 (PUP)	Ch	Mes	A
47	<i>Euphorbia helioscopia</i> L.	Perpary	Taj. Y. Bot 47 (PUP)	Th	L	A-D
Family Fabaceae						
48	<i>Albizia lebbik</i> K.	Serin	Taj. Y. Bot 48 (PUP)	Mp	N	D
49	<i>Cicer arietinum</i> L.	Channa	Taj. Y. Bot 49 (PUP)	Th	Mic	CU
50	<i>Dalbergia sissoo</i> Roxb.	Shawa	Taj. Y. Bot 50 (PUP)	Mp	N	W-D
51	<i>Melilotus indica</i> (L.) All	Markindye	Taj. Y. Bot 51 (PUP)	Th	N	D
52	<i>Pisum sativum</i> L.	Matar	Taj. Y. Bot 52 (PUP)	Th	N	CU
53	<i>Trifolium repens</i> L.	Wild Shaftala	Taj. Y. Bot 53 (PUP)	Th	N	CU
54	<i>Trifolium alexanderanum</i> L.	Shaftala	Taj. Y. Bot 54 (PUP)	Th	N	CU
55	<i>Alhagi maurorum</i> Medik.	Tandu	Taj. Y. Bot 55 (PUP)	H	L	D
Family Fumariaceae						
56	<i>Fumaria indica</i> (Hauskn.) Pusgsley	Ser gulay	Taj. Y. Bot 56 (PUP)	Th	N	A
Family Rubiaceae						
57	<i>Galium aparine</i> L.	Shakhawina	Taj. Y. Bot 57 (PUP)	Th	L	WP-A
Family Malvaceae						
58	<i>Gossypium herbaceum</i> L.	Karbeska	Taj. Y. Bot 58 (PUP)	Np	Mes	CU
Family Meliaceae						
59	<i>Melia azedarch</i> L.	Bakarna	Taj. Y. Bot 59 (PUP)	Mp	L	GY
Family Mimosaceae						
60	<i>Acacia modesta</i> Wall.	Palosa	Taj. Y. Bot 60 (PUP)	Mp	L	D
61	<i>Acacia nilotica</i> (L.) Willd. Ex. Delile	Kikar	Taj. Y. Bot 61 (PUP)	Mp	L	D
Family Moraceae						
62	<i>Morus alba</i> L.	Speen toot	Taj. Y. Bot 62 (PUP)	Mp	Mes	A
63	<i>Morus nigra</i> L.	Tor toot	Taj. Y. Bot 63 (PUP)	Mp	Mes	A
64	<i>Ficus carica</i> L.	Tughu	Taj. Y. Bot 64 (PUP)	Np	Mes	D
Family Myrtaceae						
65	<i>Euclyptus maculata</i> L.	Lochai	Taj. Y. Bot 65 (PUP)	Mp	N	D
Family Lamiaceae						
66	<i>Mentha arvensis</i> L.	Podena	Taj. Y. Bot 66 (PUP)	G	Mic	W
67	<i>Mentha longifolia</i> L.	Veluna	Taj. Y. Bot 67 (PUP)	G	Mic	W
Family Oxalidaceae						
68	<i>Oxalis corniculata</i> L.	Trwika	Taj. Y. Bot 68 (PUP)	Th	N	W
Family Papilionaceae						
69	<i>Lathyrus sativus</i> L.	Mater	Taj. Y. Bot 69 (PUP)	Th	N	A
70	<i>Medicago laciniata</i> (L.) Mill	Pisteray	Taj. Y. Bot 70 (PUP)	Th	N	A
71	<i>Medicago sativus</i> L.	Pisteray	Taj. Y. Bot 71 (PUP)	H	N	A
72	<i>Vicia sativa</i> L.	Arwari	Taj. Y. Bot 72 (PUP)	Th	N	A
73	<i>Scandix pecten-veneris</i> L.	Asmani gulay	Taj. Y. Bot 73 (PUP)	Th	Mic	D
Family Plantaginaceae						
74	<i>Plantago amplexicaulis</i> Cav.	Ghwajuba	Taj. Y. Bot 74 (PUP)	Th	N	D
75	<i>Plantago lanceolata</i> L.	Ghwajuba	Taj. Y. Bot 75 (PUP)	Th	N	W
76	<i>Plantago ciliata</i> Desf.	Ghwajuba	Taj. Y. Bot 76 (PUP)	Th	N	D

Family Polygonaceae						
77	<i>Rumex dentatus</i> L.	Terwika	Taj. Y. Bot 77 (PUP)	Th	Mic	W
78	<i>Persicaria glabra</i> willd.	Chawae	Taj. Y. Bot 78 (PUP)	Th	Mes	W
Family Punicaceae						
79	<i>Punica granatum</i> L.	Anar	Taj. Y. Bot 79 (PUP)	Mp	Mic	D
Family Ranunculaceae						
80	<i>Ranunculus muricatus</i> L.	Zergulay	Taj. Y. Bot 80(PUP)	G	Mic	WP
Family Rhamnaceae						
81	<i>Zizyphus mauritiana</i> Lam.	Kubli bera	Taj. Y. Bot 81 (PUP)	Mp	N	D
82	<i>Zizyphus nummularia</i> Burm. f.	Karkana	Taj. Y. Bot 82 (PUP)	Mp	N	D
Family Solanaceae						
83	<i>Datura metal</i> L.	Batura	Taj. Y. Bot 83 (PUP)	Np	Mes	D
84	<i>Datura innoxia</i> Mill.	Batura	Taj. Y. Bot 84 (PUP)	Th	Mes	D
85	<i>Solanum incanum</i> L.	Makoo	Taj. Y. Bot 85 (PUP)	G	Mic	D
86	<i>Lycopersicum esculentum</i> Mill.	Tamater	Taj. Y. Bot 86 (PUP)	Th	Mic	CU
87	<i>Solanum melongena</i> L.	Bingan	Taj. Y. Bot 87 (PUP)	H	Mic	CU
88	<i>Solanum nigrum</i> L.	Tor makoo	Taj. Y. Bot 88 (PUP)	Th	Mic	A-GY
89	<i>Solanum tuberosum</i> L.	Alu	Taj. Y. Bot 89 (PUP)	G	Mic	CU
90	<i>Nicotiana tabacum</i> L.	Tamaki	Taj. Y. Bot 90 (PUP)	Ch	Mg	CU
91	<i>Solanum surattense</i> Burm. f.	Maraghany	Taj. Y. Bot 91 (PUP)	H	N	GY
Family Rutaceae						
92	<i>Citrus limon</i> (L.) Osbeck	Nimbo	Taj. Y. Bot 92 (PUP)	Mp	Mes	CU
93	<i>Citrus medica</i> L.	Malta	Taj. Y. Bot 93 (PUP)	Mp	Mes	CU
94	<i>Citrus aurantium</i> L.	Narang	Taj. Y. Bot 94 (PUP)	Mp	Mes	CU
Family Spindaceae						
95	<i>Dodonea viscosa</i> (L.) Jacq	Sanity	Taj. Y. Bot 95 (PUP)	Np	N	D
Family Tamaraceae						
96	<i>Tamarix aphylla</i> (L.) Karst	Ghaz	Taj. Y. Bot 96 (PUP)	Mp	L	D
Family Zygophyllaceae						
97	<i>Peganum harmala</i> L.	Spelany	Taj. Y. Bot 97 (PUP)	H	L	D
98	<i>Fegonia indica</i> Hadidi	Spelaghzay	Taj. Y. Bot 98 (PUP)	Th	L	D
99	<i>Tribulus terrestris</i> L.	Makundy	Taj. Y. Bot 99 (PUP)	H	L	A-WP

Key to Abbreviations

(Life form) G-geophyte, Th-Therophyte, H-Hemi cryptophyte, Ch-Chamaephyte, Np-Nanophanerophyte, Mip- Microphanerophyte, Mesp- Mesophanerophyte, Megp Megaphanerophyte.

(Leaf form) L-Leptophyll, N-Nanophyll, Mic-Microphyll, Mes-Mesophyll, Mac-Macrophyll, Meg-Megaphyll.

(Habitat) A-Agricultural fields, D-Dry slopes, W-Wet places, CU-Cultivated, GY-Graveyards, F-Forest, M- Moist shady places, R-Rock crevices, WP-Waste places, I-Introduced, Epi-Epiphyte

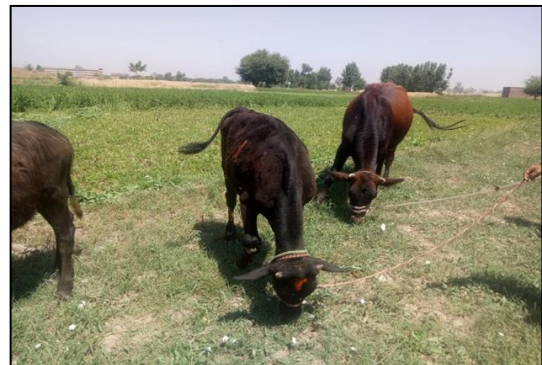
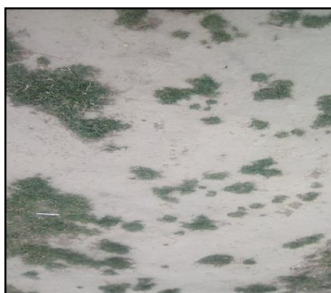


Fig 4: View of the research area showing Grazing and soil erosion

References

1. Ali SI, Qaiser M. (Eds.). Flora of Pakistan. Department of Botany, University of Karachi. 1995-2019.
2. Ali A, Badshah L, Hussain F, Shinwar ZK. Floristic composition and ecological characteristics of Plants of chail valley, district swat, Pakistan. Pakistan Journal of Botany. 2016; 48(3):1013-1026.

3. Al-Sharif E, Ayesha AAM, Rawl SM. Floristic composition life form and Chronology of plant life at Khulasai, Western Saudi Arabia. *Pakistan Journal of Botany*. 2013; 45(1):29-38.
4. Al-Sodany YM, Mosallam HA, Bazaid SA. Vegetation analysis of Mahazat Al-Sayd protected area: the second largest fenced nature reserve in the world. *World Applied Sciences Journal*. 2011; 15(8):1144-1156.
5. Badshah L, Hussain F, Sher Z. Floristic inventory, ecological characteristics and biological spectrum of rangeland, District Tank, Pakistan. *Pakistan Journal of Botany*. 2013; 45(4):1159-1168.
6. Badshah L, Hussain F, Sher Z. Floristic inventory, ecological characteristics and biological Spectrum of plants of Parachinar, Kurram Agency, Pakistan. *Pakistan Journal of Botany*. 2016; 48(4):1547-1558.
7. Durrani MJ, Hussain F, Rehman S. Ecological characteristics of plants of Harboi rangeland, Kalat, Balochistan. *Journal of Tropical. Subtropical Botany*. 2005; 13:130-138.
8. El-Ghanim WM, Hassan LM, Galal TM, Badr A. Floristic composition and vegetation analysis in Hail region north of central Saudi Arabia. *Saudi Journal of Biological Sciences*. 2010; 17(2):119-128.
9. Hussain F, Shah SM. Diversity and ecological characteristics of weeds of wheat fields of University of Peshawar Botanical Garden at Azakhel, District Nowshera, Pakistan. *Pakistan Journal of Weed Science Research*, 2009, 15(4).
10. Khan M, Hussain F, Musharaf S. Biological characteristics of plant species in Tehsil Takht-e-Nasrati Pakistan. *Journal of Biology and Environmental Science*. 2012; 2(3):42-47.
11. Khan M, Hussain F, Musharaf S, Imdadullah. Floristic composition, life form and leaf size spectra of the coal mine area vegetation of Darra Adam Khel, KPK. *Pakistan Journal of Biology and Environmental Science*. 2011; 1(3):1-6.
12. Malik ZH, Hussain F, Malik NZ. Life form and leaf size spectra of plant communities Harboring Ganga Chotti and Bedori Hills during 1999-2000. *International Journal of Agriculture and Biology*, 2007; 9(6):833-838.
13. Nasir E, Ali SI. (Eds.). *Flora of Pakistan*, Islamabad, Karachi, 1970-1989.
14. Raina AK, Kumar R. Floristic composition, life form classification and biological spectrum of the Biological spectrum of the catchment of Rattle H.E. project, District Kishtwar- J&K. *Environment Conservation Journal*. 2011; 12(3):1-6.
15. Raunkiaer C. *The life forms of plants and statistical plants geography being the collected Papers of C. Raunkiaer*. Clarendon press, Oxford, 1934.
16. Saima S, Dasti AA, Hussain F, Wazir SM, Malik SA. Floristic compositions along an 18-km long transect in ayubia National Park district Abbottabad, Pakistan. *Pakistan Journal of Botany*. 2009; 41(5):2115-2127.
17. Shah M, Hussain F. Phytosociological study of the vegetation of Hayatabad, Peshawar, Pakistan. *Pakistan Journal Plant Science*. 2009; 15(2):123-128.
18. Shah M, Rozina. Phytosociological attributes and phytodiversity of Dheri Baba Hill and Peer Taab Graveyard, district Swabi, Khyber Pakhtunkhwa, Pakistan. *Pacific Journal of Life Science*. 2013; 1(1):1-6.