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Floristic structure and other ecological attributes of flora of Dardyal Valley, district Swat, Hindukush Range, Pakistan

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This study was designed to document and assess the floristic configuration and the ecological characteristics of plant resources of Dardyal Valley, District Swat. Research work conducted during 2018-2019 revealed that local flora comprised of 338 plants belonging to 82 families and 140 genera were recorded. Based on species richness Poaceae was dominant family (35 species; 10.3%) followed by Asteraceae (29 species; 8.5%), Rosaceae (21 species; 6.2%), Brasicaceae (18 species; 5.3%), Fabaceae (17 species; 5%), Lamiaceae (14 species; 4.1%) and Boraginaceae (10 species; 2.9%). Therophytes dominated the area (164 species; 48.6%) followed by hemicryptophytes (42 species; 12.4%). *Cuscuta reflexa* was the only parasitic life form. Leaf size spectra depicted that microphylls were dominant with 117 species (34.4%) followed by nanophylls 109 species (32.2%). Majority of species (206, 61%) had simple lamina followed by compound leaves (69 species, 20.5%). Of all the recorded species only 33 were spinous. Highest numbers of species were recorded in summer (321 species, 35.9%) and spring (263 species, 29.4%). Based on habitat highest number of species 132 (31.3%) were found growing on mountain slopes. The locality has a rich and diverse flora but it is also confronting a number of threats in the form of overgrazing, soil erosion, land sliding and agricultural extension. These factors combined with anthropogenic pressures are a serious threat to local biodiversity and proper conservation strategies are need of the hour to conserve this natural wealth for generations to come.

Keywords: Floristic composition, Ecological attributes, Biodiversity, Dardyal valley, District Swat.

INTRODUCTION

Area introduction

Dardyal valley is located between 72.20º to 72.34º East longitude and 34.87º to 34.95º North latitude at distance of 20km from Tehsil Head quarter Kabal and 37km from district head quarter Saidu Sharif. The altitude of the valley varies from 900 to 3000m from the sea level. Union council Dardyal is divided into four sub village councils viz. Dardyal-1, Dardyal-2, Barasamai and Tall. The valley is guarded by Upper Dir in the North and West, Gat-Pewchar in East, Qalagai in South West and Shahdherai in South. The valley falls in moist temperate zone and it's a part of Hindukush range. (Fig.1).

Floristic

Flora is the sum total of all the wild and cultivated plants of a locality and it helps in

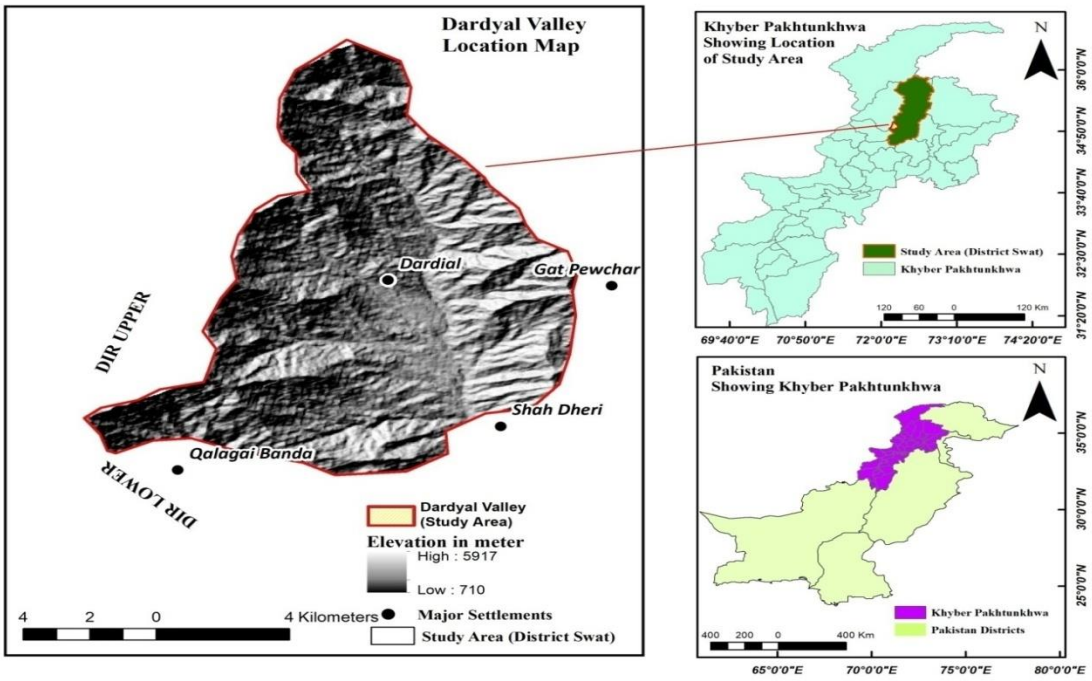

Figure1: Map of the study area

understanding the climatic and edaphic conditions of that area (Ali, 2008).

Leaf size and life form spectra depict the climatic conditions of the region (Cain and Castro, 1960). Biological spectrum is thought to be the significant indicator of macro and micro climates of the area (Shimwell, 1971). In order to determine both the life form and the climatic condition under which the life forms are evolved thus for floristic structure of any vicinity it is imperative to know the biological spectra. Leaf size spectrum explains the physiological processes of a plant and the communities as well; similarly, life form studies describe the dispersion pattern of plants and help in ranking different vegetation types found in an area (Oosting, 1956). The flora, edaphic attributes and climate are intimately related to each other and any change in any of these components will have a profound effect on the vegetation, and that's why plant communities are indicators of climatic and edaphic conditions of that particular locality (Malik, 1986). Spatiotemporal variations in a habitat as well as the interactions among the biotic components influence the distribution and structure of plant communities (Khan et al., 2013). Designing and implementing the conservation strategies need proper floristic studies, extensive plant collections and accurate identification (Khan and Ahmad, 2014).

A number of botanists have carried out floristic studies, prepared checklists and recorded the ecological attributes of different and diverse localities across Pakistan.

A study reported 99 species belonging to 37 families from Mandan area of District Bannu. Solanaceae and Poaceae were the dominant families in the locality and therophytes were the dominant life form (Khan et al., 2019). From Manoor valley, 307 plants were reported which belonged to 81 families. Asteraceae and Rosaceae were the leading families. Therophytes followed by hemicryptophytes were the dominant life forms (Rahman et al., 2018). From Jelar valley, District Upper Dir 250 plants were documented. These plants belonged to 77 families and 177 genera. Asteraceae and Lamiaceae appeared to be the dominant families of this region (Ullah and Badshah, 2017). Another extensive eco-floristic study recorded 463 plants belonging to 104 families and 332 genera from Chail valley, district Swat. Asteraceae was the leading family, therophytes the dominant life form and mesophylls the most prevalent leaf size (Ali et al., 2016). A total of 331 plant species were reported from District Torghar, including 12 species of pteridophytes (Mahmood et al., 2015). Another floristic study recorded 132 plants belonging to 47 families from Shahbaz Garhai area of District Mardan with Poaceae and

Asteraceae the leading families (Khan et al., 2014). From Koh-e-Safaid Range northern Pakistan-Afghan borders reported 654 plants distributed among 116 families in which Asteraceae and Poaceae were dominant families (Wahid et al., 2020). Literature review clearly indicates that there is no reference available on the flora and ecological characteristics of plants of Dardyal area of District Swat. Present study is an attempt to bridge this gap.

MATERIALS AND METHODS

Floristic composition

A floristic list was prepared through extensive plant collection trips and surveys on regular basis during 2018-2019. Collection tools included polythene bags, cutter, gloves, old newspapers, plant press, pencil, notebook; mercuric chloride and digital camera. The collected plants were identified with the help of available literature (Ali and Qaisar, 1995-2015, Ali and Nasir, 1989-1992, Nasir & Ali, 1970-1989). The collected plants were assigned voucher numbers and they were mounted on standard herbarium sheets. Plant specimens were deposited at the Herbarium of Qurtuba University Peshawar. A floristic list was prepared by arranging the species in alphabetical order. Life form and leaf size spectra were also noted against each species (Raunkiaer, 1934, Hussain, 1989) as per following formulae.

$$\text{(Life form spectra)} = \left(\frac{\text{Number of species found in a particular life form class}}{\text{Total number of species found in the area}}\right) \times 100$$

$$\text{(Leaf size spectra)} = \left(\frac{\text{Number of species falling in a particular leaf size class}}{\text{Total number of all species found in the area}}\right) \times 100$$

RESULTSAND DISCUSSION

Floristic configuration

Floristic configuration reflects the climatic conditions, edaphic features and anthropogenic pressures in any area. The flora of Dardyal valley consisted of 338 species distributed among 240 genera and 82 families. Among the recorded species, Pteridophytes were represented by 6 families and 15 species (4.5%), Gymnosperms with 3 families and 9 species (2.6%), Monocots with 10 families and 51 species (15.4%) while, Dicots were represented by 63 families and 263 species (77.6%). Leading families were Poaceae having 35 species (10.3%) followed by Asteraceae represented by 29 species (8.5%), Rosaceae with 21 species (6.2%), Brasicaceae with 18 species (5.3%), Fabaceae with 17 species (5%) and Lamiaceae with 14 species (4.1%). All the remaining families had less than 14 species (Table. 1). Our findings are in line with the report of Ali et al.,, (2016) who have documented Asteraceae as the dominant family from Chail valley District Swat and with that of Sher et al.,, (2011) who found Poaceae as a leading plant family in Chota Lahore area of District Swabi. Poaceae was also the dominant plant family in a floristic study conducted in District Tank (Badshah et al., 2013). Anwar et al., (2019) also reported the same families as dominant ones from Liakot forests in the Kalam region of district Swat, Pakistan. Similarly, Bibi et al., (2019) recorded Asteraceae as a leading family form lower Tanawal, Khyber Pakhtunkhwa, Pakistan. Another ecological survey also reported Poaceae and Asteraceae as principal families from Hazar Nao Hills, district Malakand, Pakistan (Ali et al., 2018)

Habit

Based on habit local flora included 247 herbs (73%), 54 trees (16%) and 36 shrubs (11%). Similar results are presented by Ullah and Badshah (2017) and Ali et al., (2017), who also reported herbs dominating the local flora in their respective study areas. Trees and shrubs are not markedly affected by seasonal variation but their dispersion is influenced by grazing, browsing and anthropogenic factors. Highest numbers of species were found in summer (321 species, 36.23%) followed by spring (262 species, 29.6%). In autumn it was reduced to 180 species (20.3%). Lowest numbers of species were found during the winter season (123 species, 13.3%).Our results are in agreement with works of Ullah and Badshah (2017), Ali et al., (2016) and Badshah et al., (2013).

Habitat

Highest number of species were recorded from mountain slopes (132 species, 31.35%) followed by agricultural fields (88 species, 20.9%) and wet places (45 species, 10.68%). From forests 43 species (10.2%) were collected. Among the other flora 34 species (8%) were cultivated, 33 species (7.8%) were found on moist places, 24 species (5.7%) in waste places, 10 species (2.4%) were found growing in the crevices of rocks, 8 species (1.9%) were collected from graveyard, 4 species (*Bambusa multiplex*, *Cupressus sempervirens, Platycladus orientalis* and *Punica granatum*) were introduced and a single species *Cuscuta reflexa* (0.2%) was epiphytic (Fig. 2).

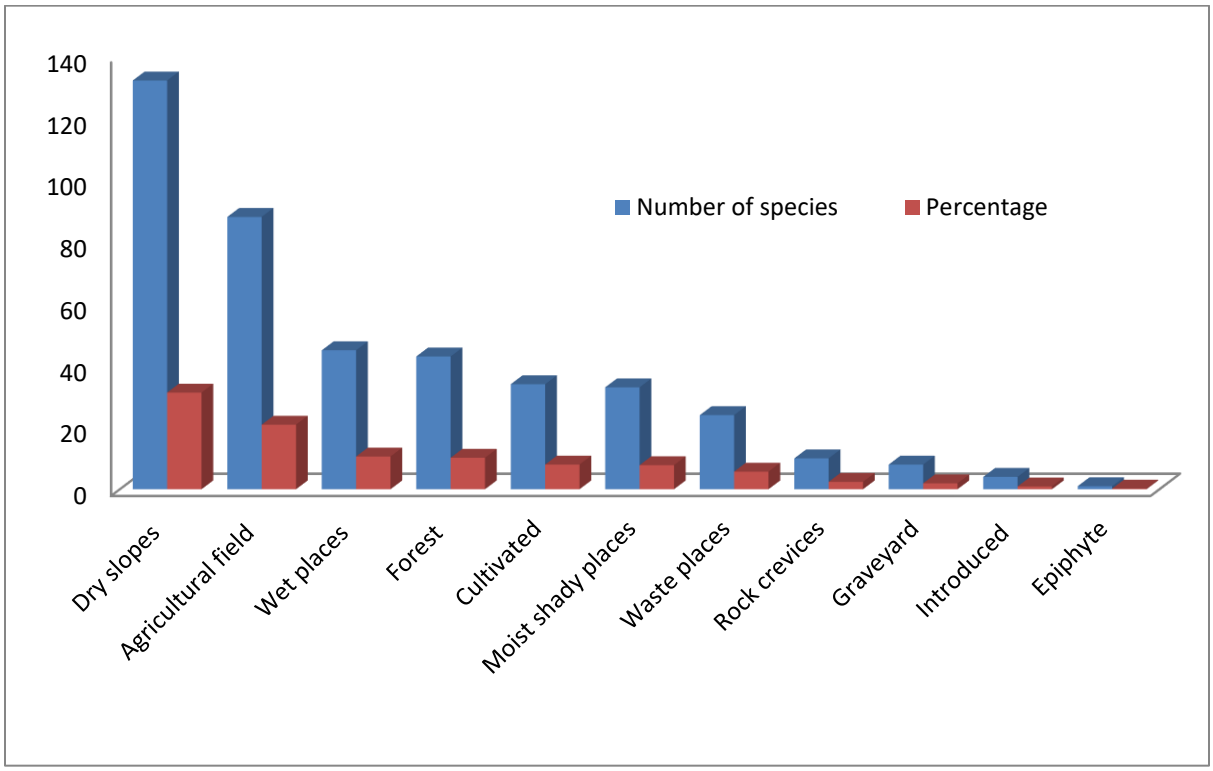

Figure 2: Habitat distribution of flora

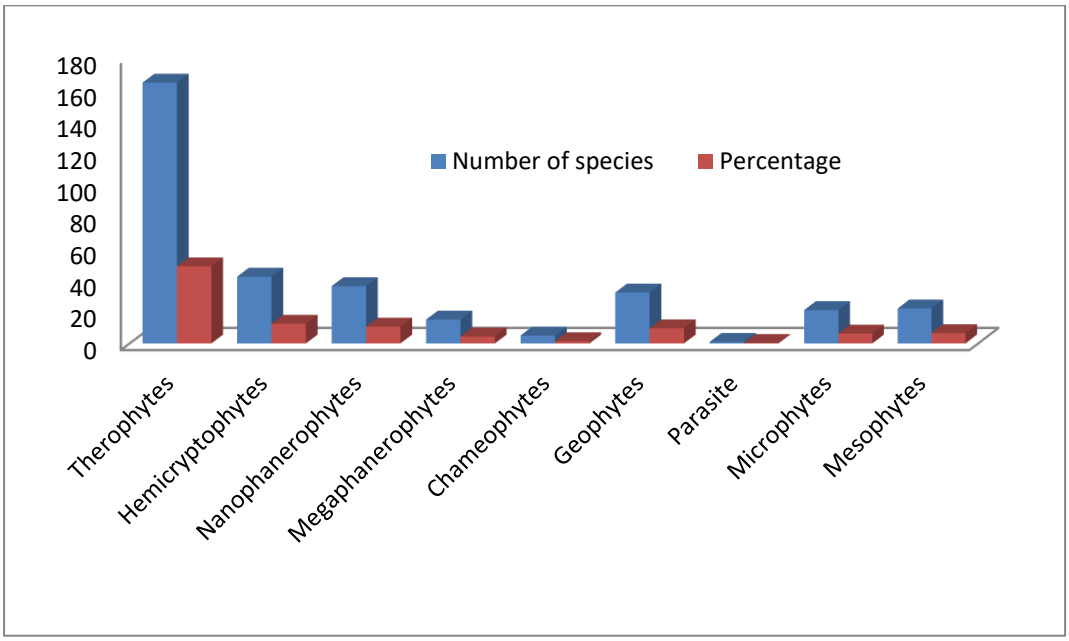

Figure 3: Life form classes

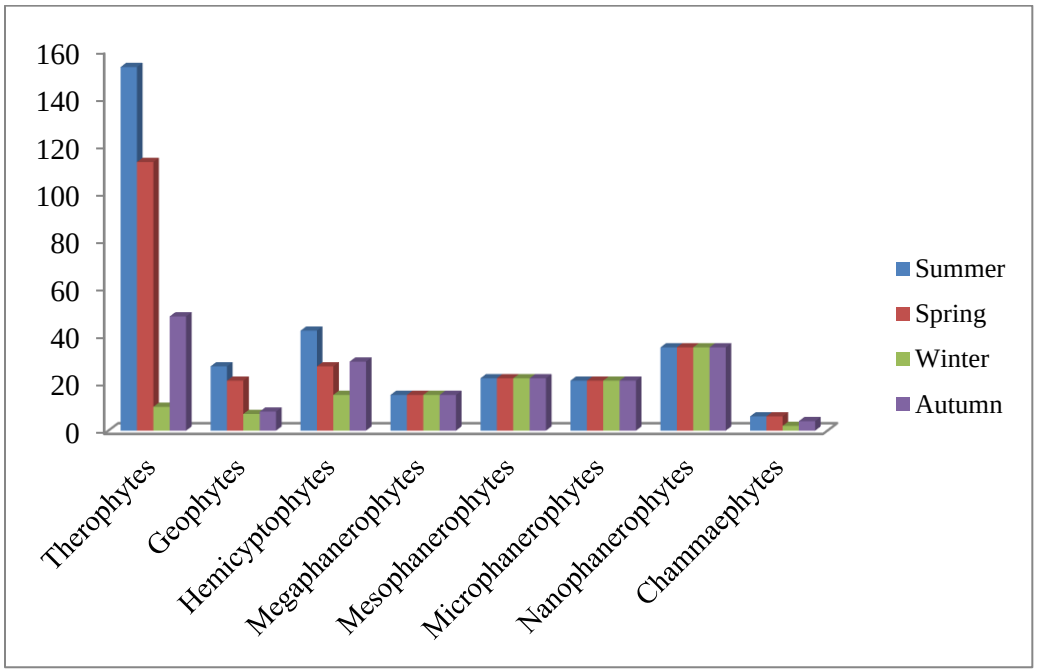

Figure 4: Seasonal variation in life form

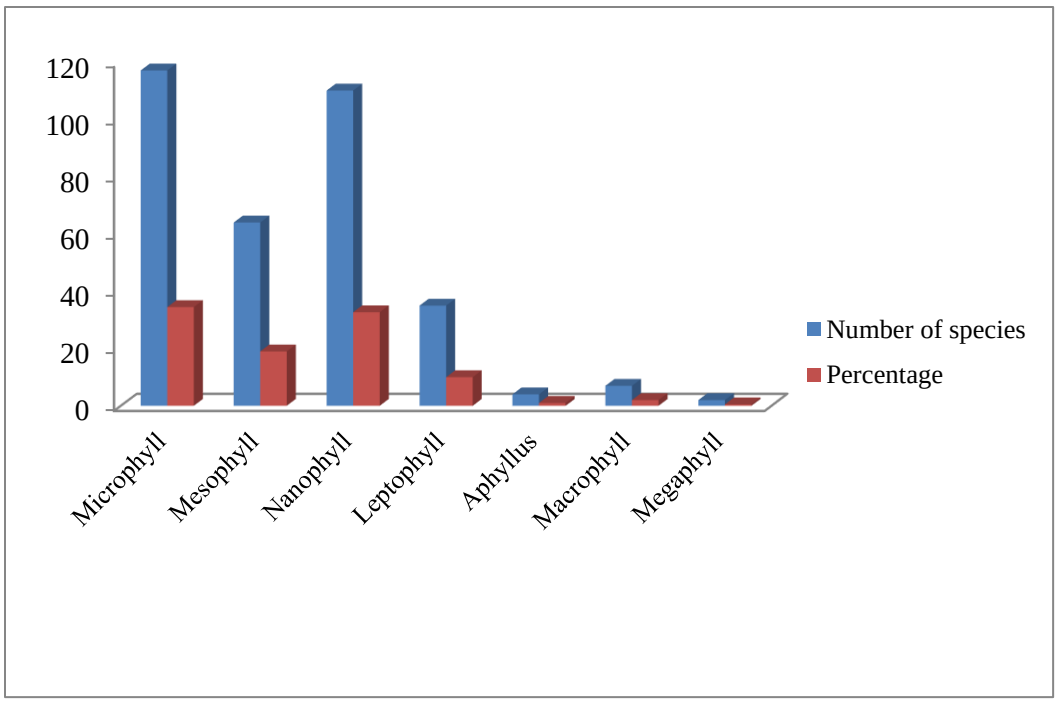

Figure 5: Leaf size classes

Our results are strongly in agreement with floristic studies conducted in Darazinda (Samreen et al., 2016a) and Jelar valley (Ullah and Badshah, 2017). These workers have also collected maximum number of species from mountain slopes. Anthropogenic factors, deforestation, loss of habitat and climatic change contribute in low species richness and loss of biodiversity (Hussain et al., 2015).

Lamina shape

The recorded flora indicated that highest number of species (206, 61.2%) possess simple lamina followed by compound leaves (69 species, 20.5%), dissected leaves (52 species 15.5%) and needle shaped leaves (7 species, 2%). Whereas, 3 species were with no lamina and 1 species (*Opuntia monocantha*) had spiny lamina. Similar studies were also conducted by (Ullah and Badshah, 2017) from Jelar valley District Dir Upper and (Haq et al., 2019) from Keran-a remote valley of North Western Himalaya who reported the largest number of species with having simple lamina followed by compound.

Life form

Life form is the key indicator of micro and macro climatic condition of an area Shimwell, (1971). Based on position of perennating bud Raunkiaer, (1934) proposed a life form classification system. Results of life form classification revealed that therophytes were dominant life form with (164 species, 48.6%) followed by hemicyptophytes (42 species, 12.5%), nanophanerophytes (35 species, 10.4%), geophytes (32 species, 9.4%), mesophanerophytes (22 species, 6.5%), microphanerophytes (21 species, 6.2%), megaphanerophytes (15 species, 4.4%) and chammaephytes having lowest number (6 species, 1.7%) (Fig. 3).

Therophytes as a dominant life form class were also reported by (Rafay et al.,, 2013) from Cholistan desert and (Inayat et al.,, 2014) from District Charsada. Our findings are strongly backed by (Ullah and Badshah, 2017) and (Ali et al.,, 2016) who recorded therophytes as a dominant class followed by hemicryptophytes and phanerophytes.

The dominant character of therophytes represent the distressed environmental condition as a result of anthropogenic factors because in normal spectra hemicryptophytes are indicate high altitude and geophytes are the characteristic species of Mediterranean climate while, therophytes are the indicator species of xeric climate (Menhas et al., 2010).

Seasonality and life form

Seasonal variation in different life form classes showed that the highest number of species were found in summer while, lowest number in winter due to cruel climatic condition. In summer therophytes were dominant life form with (153 species), hemicryptophytes with (42, species) then nanophanerophytes having 36 species. In spring the therophytes were also leading life form (113 species) next nanophanerophytes (36 species) then hemicryptophytes with 27 species, but in winter the nanophanerophytes were dominant (36 species) followed by microphanerophytes (21, species) then hemicryptophytes and megaphanerophytes with 15 species each. In autumn again the dominant class were therophytes (48, species) then nanophanerophytes with (36 species) and hemicryptophytes consisted of (29 species) (Fig. 4).

Leaf size

Leaf size spectra were also assessed according to Raunkaerean formula the dominant class was microphylls with (117 species, 34.5%) followed by nanophylls (110 species, 32.7%), mesophylls with (64 species, 19%), leptophylls having (35 species, 10%), macrophylls (7 species, 2%), aphyllous (4 species, 1%) and megaphhylls with 2 species 0.5% (Fig. 5).

Leptophylls followed by microphylls were also reported to be dominant leaf sizes from Basu hills, Sakardu (Amjad and Hameed, 2012). Our findings are also in line with reports from Chail valley, Swat and Sherpao, District Charsadda (Ali et al., 2016; Ali et al.,, 2017). Another study documented microphylls as dominant leaf size followed by nanophylls, from Shahbaz Garhi, District Mardan (Khan et al., 2014). The percentage of different leaf size classes vary with change in altitude (Saxen et al., 1987; Ullah and Badshah, 2017).

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Floristic configuration and ecological characteristics of Dardyal valley, District Swat is provided as supplementary material (Table: S1).

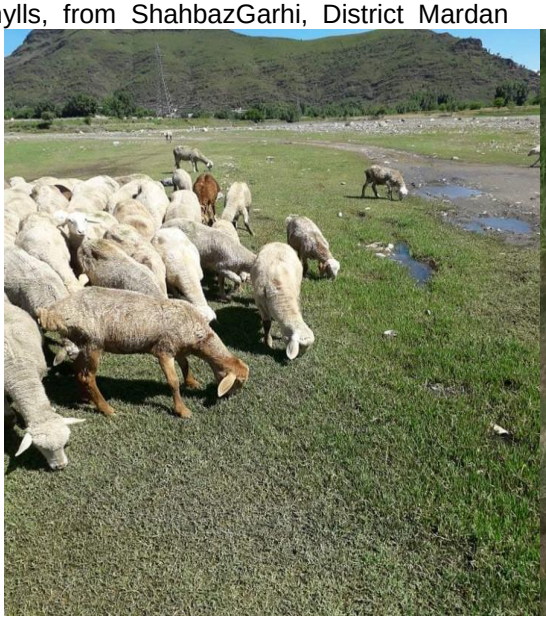

Figure 7: Sheep graze upon herbaceous

Figure 8: Cow graze upon grass Flora

Figure 9: Land sliding causes erosion

Figure 10: Soil erosion due to water

CONCLUSION

It is concluded that the flora of the valley is diverse. Phytoclimate of the valley is of therophytic type and the climatic conditions of the area are greatly influenced by biotic pressure on the flora which promotes short lived species in the locality. This study provides baseline information on the flora of the area and further study is recommended for the exploration of quantitative information of vegetation.

CONFLICT OF INTEREST

The authors declare that present study was performed in absence of any conflict of interest.

ACKNOWLEGEMENT

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AUTHOR CONTRIBUTIONS

SU, AA and LB designed the study, HU and FH collected the field data. HU prepared the herbarium sheets. SU and AA prepared the manuscript. LB identified the plant specimen and finalized the manuscript.

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