A Multivariate Assessment of Herbaceous Vegetation at Shinghar Valley, District Zhob, Pakistan

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Abstract: The herbaceous vegetation of Shinghar valley, District Zhob is consociated with Chilghoza forest and significantly contributes to preserve overall forest ecosystem. The present study was undertaken for the quantification of herbaceous vegetation. The floristic composition was accomplished by quadrats method followed by Braun-Blanquet's cover scale, 30 species belonging to 17 families were recorded by the visual estimation, from 200 quadrates taken randomly from selected three zones. After species identification, TWINSPAN Analysis was applied. Different vegetation has been classified into different communities. The whole classification of flora was shown in the two-way cluster dendrogram. The most dominant species present in the three zones were *Ephedra intermedia*, *Sophora mollis*, *Cotoneaster nummularia* and *Peganum harmala*. DCA was applied to formulate the major communities and showed consistency with the results obtained from TWINSPAIN. The whole research provided a wealth of information in species conservation for future research.

Key words: Classification · Quantification · Herbaceous flora · Chilghoza forest · Shinghar valley

INTRODUCTION

The northern region of Pakistan occupies the most alluring series of mountains [1]. Due to extreme climatic variations, mountains possessing the most vital vegetational lands and plants adapted to such altitudinal conditions. Mountain ecosystem requires a proper documentation for quantification and record. It is considered that in order to maintain the overall systems in the mountain ecosystem it is essential to sustain the plant biodiversity [2]. A large portion of forest biodiversity is composed of the herbaceous layer [3,4]. Balochistan is sanctied with diverse flora and fauna due to various ecological environments [5]. About 89,000 hectares area is covered by the mountainous series of Suleiman, blessed with edible and economically active Chilghoza forest. The herbaceous layers consociated with the Chilghoza forest is very significant and promotes the biodiversity [6]. Multivariate practices helps in the vegetation classification into groups and communities. The classification of the herbaceous vegetation is carried out by very efficient computer based software which is widely applied by ecologist on national and international scale. In Ayubia National Park a research was accomplished in order to identify the relationship between the diversity of vegetation species and its overall community grouping by using multivariate tools [7]. Same methodology was applied for the herbaceous vegetation of the Gatwala Forest Park, Faisalabad [8]. Researcher also confirmed the classification of herbaceous vegetation data in Changa Manga Park Lahore by the TWINSPAN [9]. The main purpose of the present study was to illuminate the significance of herbaceous flora of the study area by the aid of ordination classification method.

MATERIALS AND METHODS

Selection of Study Site: Shinghar valley is about 50 km away from district Zhob, almost situated to the west of the Takht-e-Sulaiman. Shinghar lies at 31^0–36' North and from 69^0–59' East. Main peak of Shinghar is about 9273 ft. It is located at an altitude of 2103 m above the sea level. Valley has an edible Chilghoza forest, that covers an area of about 1036 hectares [10].

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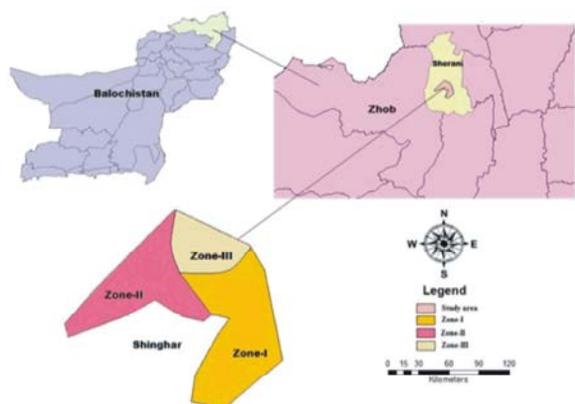
Fig. 1: Map of study area

Zonation of the Study Area: The study area comprised of three zones divided on the basis of chilghoza forest density. Zone-I occupied thick forest (60% of the area.), Zone-II moderate forest (30%) and Zone-III. The third zone consisted sparse (forest 20 % of the valley).

Floristic Sampling: Survey of Shinghar valley, District Zhob was carried out during August, 2014. Vegetation data was collected through random sampling by using quadrate method. Quadrate of size 1×1 m^2 was used followed by the Braun-Blanquet's cover scale. Visual estimation (%) was recorded for each species occurred in each quadrate [11]. A total of 200 quadrates were laid down in the three zones. Zone I consisted of 120 quadrates, zone II comprised of 50 quadrates and in zone III about 30 quadrats. Species were collected, preserved and identified by botanical specialist and confirmed through literature [12]. TWINSPAN was applied for the quantification and classification of vegetation data. PC-ORD 5 gives classification techniques like TWINSPAN (Two Way Indicator Species Analysis) and DCA (Detrended Correspondence Analysis). Present research was performed to elucidate the distribution of floral vegetation, major groups of herbaceous species were derived into communities formulated due to effective ordination classification.

RESULTS AND DISCUSSION

Floristic Profile (Zone I, II and III): About thirty herbaceous species belonging to 17 families were identified from the whole study area. The species that dominated the valley to a greater extent were *Ephedra intermedia, Sophora mollis, Teucrium patulum, Cotoneaster nummularia, Stachys parviflora, Stipa*

orientalis and *Peganum harmala*. Species abundance and richness seemed to be less as compare to the total area of the site. Species identified in the study area were mostly bushy, spiny and succulent. One study conducted in Kalat, Balochistan concerning the palatability and animal preferences of different plants. Results showed that about 129 plants species were categorized as highly palatable species among which *Ephedra intermedia* and *Sophora mollis* were the most palatable evergreen perennial species [13]. Species diversity can be measured as species affluence and as the number of species present in vicinity [14]. Habitat quality or the environment type can represents the variation in the community at spatial scale including species abundance, richness and evenness [15].

TWINSPAN Classification: Herbaceous species were classified by cluster analysis conducted by TWINSPAN. Arshad 2013 carried out one research involved the assessment of herbaceous vegetation in Chitral Gol National Park. TWINSPAN, analyzed the whole data and classified the results into four communities [16]. Another study was focussed basically on the identification and classification of vegetation, application of TWINSPAN resulted in categorizing of the plant species into 4 groups. DCA was carried out in order to know the dominant species present in the whole study site [17]. On the basis of analysis, Zone-I comprised of about 18 species recorded from about 120 quadrats. Zone-II consisted of 25 species while zone-III consisted of 24 species. The most abundant species that scattered throughout the valley were *Ephedra intermedia*, *Sophora mollis*, *Teucrium Patulum*, *Cotoneaster nummularia* and *Peganum harmala*. Several studies reported that *Ephedra intermedia* and other shrubs species grows immensely in arid conditions [18].

Two Way Dendrogram represents the classification of vegetation (Fig. 2). Dendrogram represents not only the plant species classified into major groups and communities but it also highlited the dominent species present in each community. Zone-I flora was divided into two main groups A and B. Group A comprised of only one dominant specie i.e. *Nepeta praetervia*. Group B was further divided into four delineated communities as shown in figure 3. Names are given to communities on the basis of two dominant species present in each community. Community-I Ephedra-Cotoneaster (eph-cot) was the largest community comprised of about ten species. Community-II Tetrapogon-Stellaria (Tet-ste) consisted of
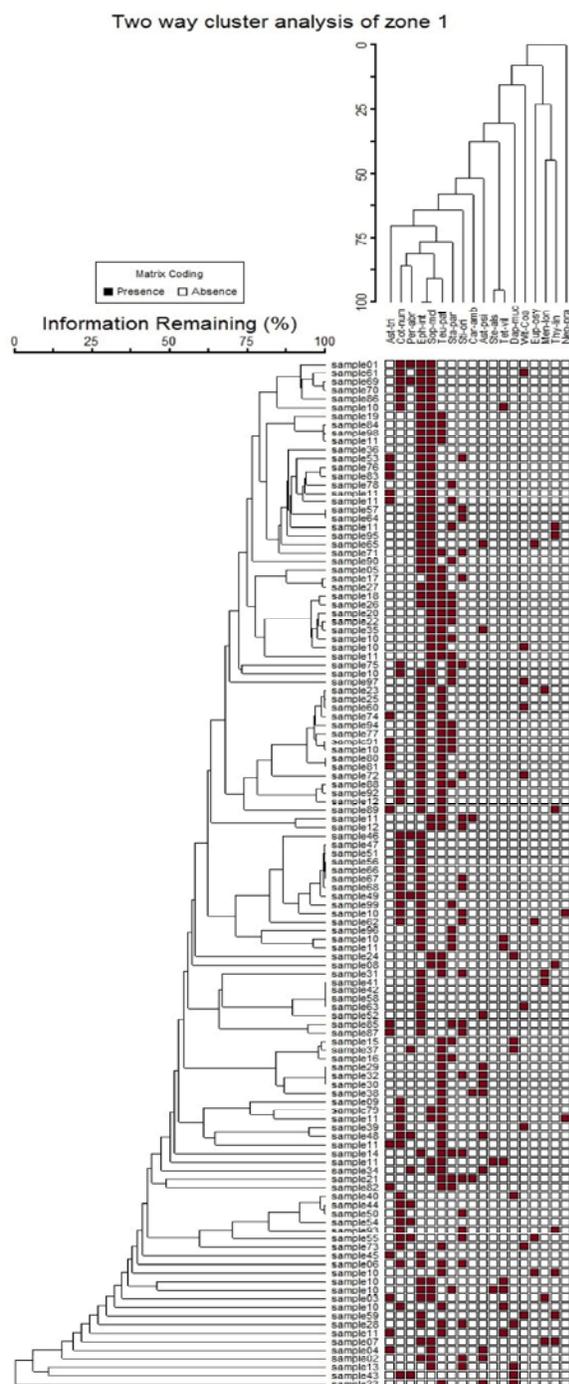
Two way cluster analysis of zone 1

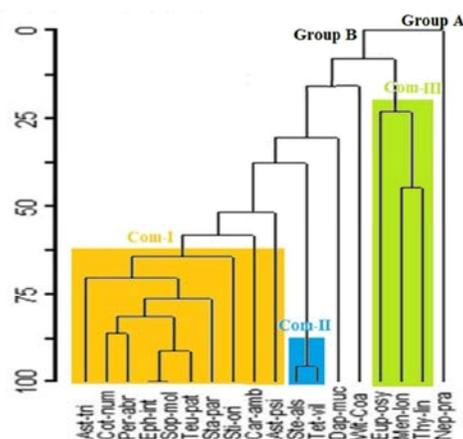Fig. 2: Cluster analysis of Zone-I

Fig. 3: Delineated communities of Zn-I

The floral diversity of zone-II was more diverse than zone-I on the basis of number of species indentified. Figu. 4 showed the division of whole vegetation. In Fig. 5, group A is indicated as community-VI Stachys-Nepeta (sta-nep). It comprised of two species i.e. *Nepeta praetervisa* and *Stachys parviflora.* Group B is divided into five communities. Each community i.e. community-I Ephedra-sophora (eph-sop), community-II Thymus-teucrium (thy-teu), community-III Stellaria-peganum (ste-peg) consisted of four species. Similarly, Community-IV Zygophyllum-ferula (zyg-fer) and community-V Tetrapogon-haloxylon (tet-hal) both consist of five species. Only one specie i.e. *Cotoneaster nummularia* did not show any relation to form any possible community with other species present in group B.
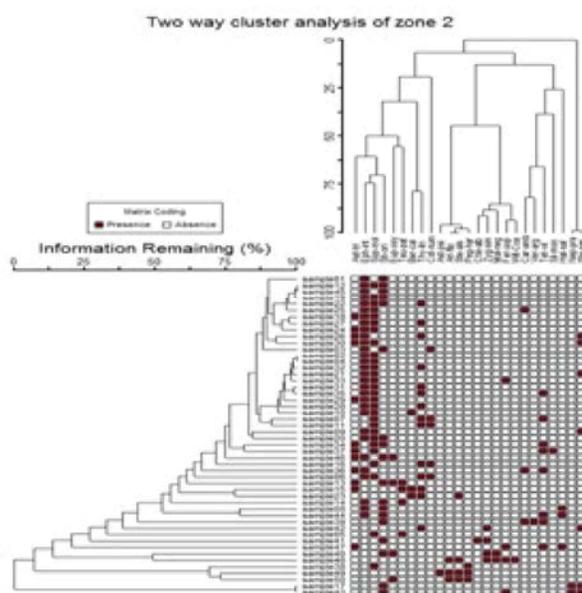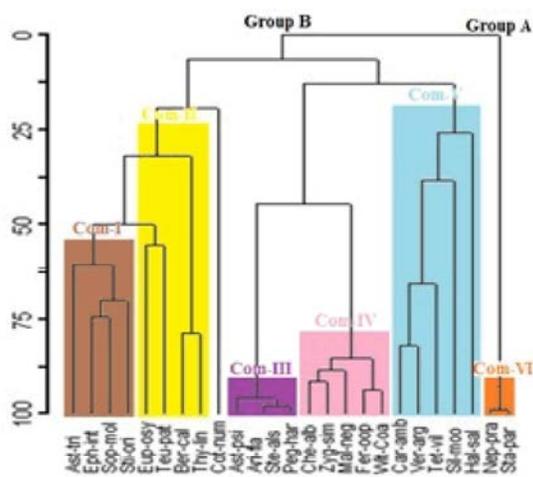

Fig. 4: Cluster analysis of Zone-II

only two species i.e. *Tetrapogon villosus* and *Stellaria alsinoides*. Community-III Thymus-mentha (thy-men) consisted of three species. Two species in group B, *Dephne mucronata* and *Withania coagulans* did not appeared in any community but they emerged in group B.

Fig. 5: Delineated communities of Zn-I

Fig. 7: Delineated communities of Zn-III

The classification of zone-III in figure 6 reptresented the whole flora divided into two main groups i.e. group A and B represented in Fig. 7. The adjacent first two communities of group B consist of three species. Community-III was abundantly scattered with *Stellaria alsinoides* and *Sophora mollis* therefore named as Stellaria-sophora (ste-sop). In community-VI Stachys-silybum (sta-sil), the dominant species were *Stachys parviflora* and *Silybum marianum*. Community-V Malva-zygophyllum (mal-zyg) also consisted of four species among which *Malva neglecta* and *Zygophyllum simplex* were the most dominant. Nepeta-Stipa (nep-sti), the very last community was named after the two most dominant species.
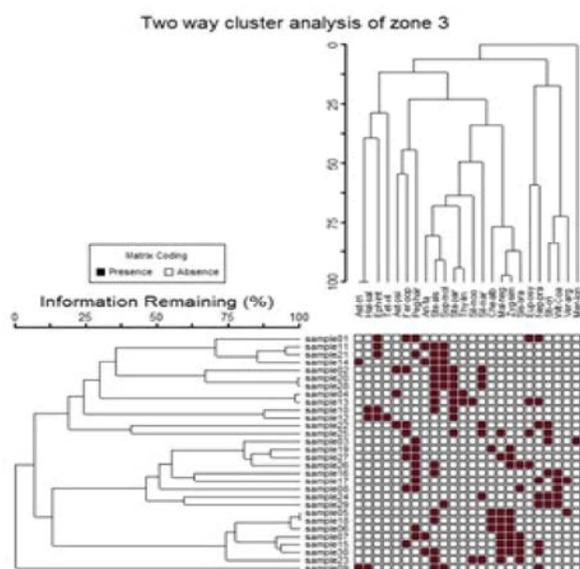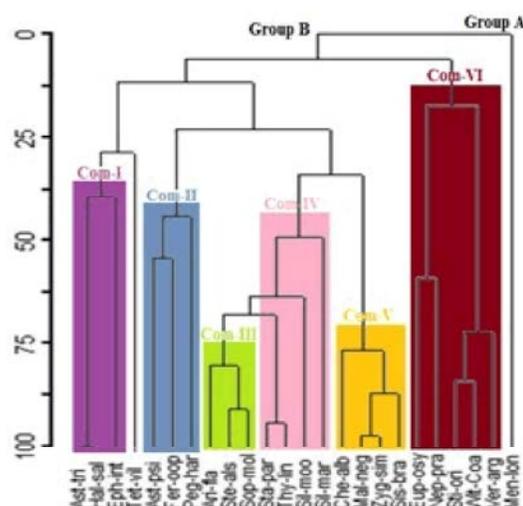

Fig. 6: Cluster analysis of Zone-III

DCA Classification: In the present study ground floral classification was accomplished by TWINSPAN but ordination was achieved through Detrended Correspondence Analysis (DCA). To verify the results obtained from TWINSPAN another application called Detrended correspondence analysis (DCA) was practicalize. The results obtained by DCA showed consistency as the major communities were also present in the delineated results shown in Two-Way Cluster Dendrogram. The DCA results showed that herbaceous species of the study area were divided into two major and two minor groups. In zone-I, major group I consist of *Ephedra intermedia*, *Sophora mollis*, *Cotoneaster nummularia*, *Stachys parviflora*, *Astragulus tribuloides* and *Nepeta praetervisa* which seemed to show coherency with classification result shown by TWINSPAN. Major group II consist of *Tetrapogon villosus*, *Stellaria alsinoides, Euphorbia osyroidea*, *Mentha longifolia* and *Thymus linearis*. Similarity was shown with TWINSPAN results. Similarly minor group I consisted of two species *Astragulus psilocentros* and *Teucrium patulum*. Minor group II also comprised of two species *Perovskia abrotanoides* and *Stipa orientalis*. Both of the minor groups comes under community-I according to TWINSPAN results. *Dephne mucronata* did not showed any association with groups of zone-I and shown as an outliers in DCA figure 8.

DCA for zone-II is shown in figure 8. DCA revealed that major group I comprised of *Euphorbia osyroidea*, *Berberis calliobotrys*, *Thymus linearis* (TWINSPAN, Com-II) *Arisaema flavum*, *Stellaria alsinoides*, *Peganum harmala* (TWINSPAN, Com-III) *Chenopodium album*,
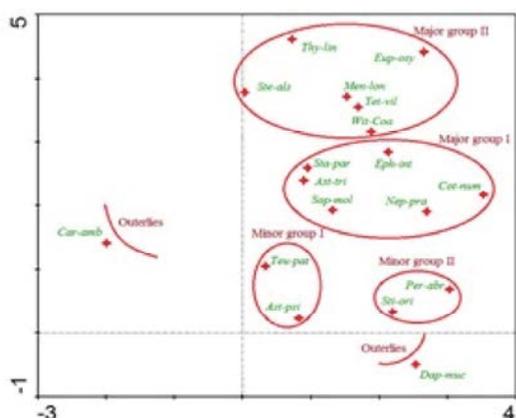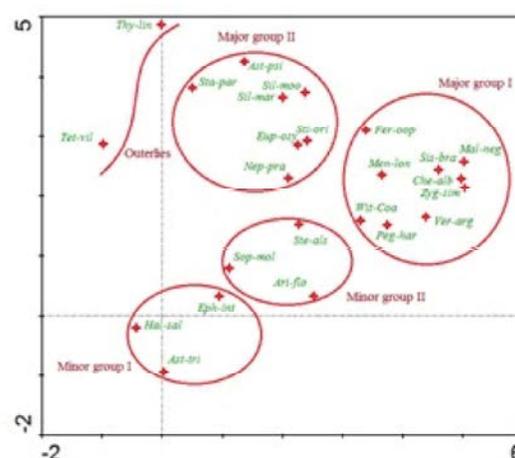
Fig. 8: DCA of Zone-I
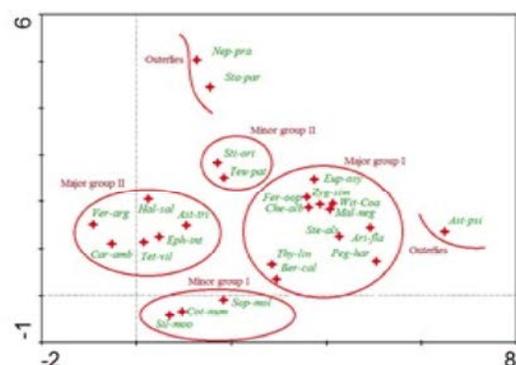

Fig. 10: DCA of Zone-III

Fig. 9: DCA of Zone-II

Zygophyllum simplex, *Malva neglecta*, *Ferula oopoda* and *Withania coagulans* (TWINSPAN, Com-IV). Species covered in Major group II were *Ephedra intermedia*, *Astragulus tribuloidses* (TWINSPAN, Com-I) *Caragana ambigua*, *Veronica agrestis*, *Tetrapogon villosus* and *Haloxylon salicornicum* (TWINSPAN, Com-V). Similarly, minor group I consisted of *Silene moorcfroftiana*, *Cotoneaster nummularia* and *Sophora mollis*. Whereas minor group II comprised of *Teucrium patulum* and *Stipa orientalis*. In DCA two species *Stachys parviflora* and *Nepeta praetervisa* were marked as outliers. TWINSPAN result confirmed that these two species were divided separately in group A. DCA results showed coherency with the TWINSPAN result.

DCA of zone-III showed the first major group I consisted of *Chenopodium album, Malva neglecta, Zygophyllum simplex, Sisymbrium brassiciforme* (TWINSPAN, Com-V). Similarly major group II consisted of *Astragulus psilocentros* (TWINSPAN, Com-II), *Stachys parviflora, Silybum marianum,* (TWINSPAN, Com-IV), *Euphorbia osyroidea*, *Nepeta praetervisa*,

Stipa orientalis (TWINSPAN, Com-VI). Minor group I of zone-III was composed of *Astragulus tribuloidses*, *Haloxylon salicornicum*, *Ephedra intermedia* (TWINSPAN, Com-I) and minor group II consisted *Arisaema flavum* and *Sophora mollis* (TWINSPAN, Com-III). In DCA results, two species *Thymus linearis* and *Tetrapogon villosus* were marked as outliers. DCA, results showed consistency with the delineated result of TWINSPAN.

CONCLUSION

Shinghar valley is a remote area of Balochistan, famous due to edible Chilghoza forest. Records of classification of herbaceous vegetation were missing in literature. As the study area is used as a picnic point and the local people being unaware of the bad outcomes. So, in order to conserve the precious stand of Chilghoza forest, cost effective management program should be introduced in order to promote and protect the viable herbaceous species and forest ecosystem. The outcomes of the study will form a baseline for the development of enhanced management practices and for the continuation of future research with the preservation of natural vegetation overlaying in the Shinghar Valley.

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