Pak. J. Weed Sci. Res., 23(1): 103-117, 2017

RANGE AND FOREST VEGETATION ANALYSIS ALONG THE ALTITUDINAL GRADIENT IN LOWER DIR, KHYBER PAKHTUNKHWA- PAKISTAN

Sara Hidayat[1], Aamir Saleem[2], Haroon Khan[3,*], Munawar Zeb[1], Bakhtiar Gul[3] and Wisal Muhammad Khan[4]

ABSTRACT

Vegetation analysis interprets the vegetation within a habitat and altitudinal gradient influence habitat and vegetation structure and is a task of interest for the plant ecologists. The present study was carried out in Lower Dir, Khyber Pakhtunkhwa Province with an altitudinal difference of 750-2150 m elevation. Sample plots of 0.1 ha were taken at altitudinal interval of 100 m using Geographical Positioning System (GPS). To find out species dominance at each altitude, a total of 45 sample plots were selected (3 elevation^{-1}). A total of 57 species belonging to 30 families were documented, of which 25 were trees, 16 herbs, 9 shrubs, and 7 grasses. Their relative frequency, density and cover were also recorded. The plant species were classified on the basis of their frequency (%) and Importance value index (IVIs). The findings of this study revealed that Cynodon dactylon, Aristida depressa and Rumex hastatus were the dominant species and provides valuable information on floristic composition and life forms of the plant species of the study area. This study will help the researchers to pinpoint the endangered and newly introduced or invasive species in the study area as well as how to cope with the upcoming environmental and climatic threats to the native vegetation.

Key words: Vegetation analysis, Range, Forest, Dir-Pakistan.

Citation: Hidayat, S., A. Saleem, H. Khan, M. Zeb, B. Gul and W.M. Khan. 2017. Range and forest vegetation analysis along the altitudinal gradient in Lower Dir, Khyber Pakhtunkhwa, Pakistan. Pak. J. Weed Sci. Res. 23(1): 103-117.

[1]Dept. of Forestry, SBB University, Upper Dir, Pakistan
[2]Forestry and Range Management, University of Arid Agriculture Rawalpindi, Pakistan
[3]Dept. of Weed Science, University of Agriculture Peshawar Pakistan
[4]Dept. of Botany, Islamia College, Peshawar, Pakistan
*Corresponding author's email: haroonkhan@aup.edu.pk

INTRODUCTION

Pakistan has a geographic position of 24°-37 N latitude and 61°-75.5 E longitude. The country covers a total area of 7,96,096 km^2. Of the total area, 58.79 % (4,68,000 km^2) lies in the mountainous region as well as plateaus of North and East. The rest of the area (41.21 % or 3,28,000 km^2) constitutes the plains. The environment of Pakistan varies significantly from permafrost and soaring peaks of Himalayan range in the North to the super heated deserts and hot waters of Arabian Sea in the South (Anon., 2006).

The changes in the abiotic conditions (climate, soil and temperature) along altitudinal gradient ultimately affect the composition and distribution of species. The relationship between vegetation and altitude has been studied since the early 19th century (Kala and Mathur, 2002). Vegetation change along the altitudinal gradient is obvious and can be calculated in terms of composition and richness of species (Lomolino, 2001). Similarly, ecologists have revealed the existence inter and intra species disparity along altitudinal gradients in hilly ecosystems (Vetaas and Grytnes, 2002). Altitudinal gradient is a determining factor of species diversity (Gaston, 2000; Li and Zhou, 2002; Lan, 2003; Tang *et al*., 2004).

Muhammad *et al*., (2016) studied the physiochemistry of the forest stand in Malakand division KPK and recorded a total of 3836 individuals plants, from 32 species and belonging to 20 angiosperms families. Among the understory vegetation asteraceae, poaceae and sapindaceae were the dominant families in terms of taxonomic diversity and family importance value (FIV) index. Champion *et al*. (1965) and Beg (1975) carried out an observational survey and recognized various types of forests and different vegetation zones on the basis of temperature and altitude. Rafi (1965) carried out similar studies in Balochistan. Hussain and Illahi (1991) presented ecology and vegetation types for Lesser Himalayan of Pakistan. Hussain (1984) described vegetation of Pakistan with particular emphasis on vegetation of Karachi. Ahmed (1974) conducted extensive phyto-sociological sampling in Himalayan region during a scientific expedition in northern areas of Pakistan. Irshad *et al.,* (2016) reported a total of 20 tree species belonging to 13 families of 19 genera with 78 species occurring understory of these trees in Lower Dir district of KPK. While Khan *et al.,* (2013) reported the major weeds of wheat in different ecological zones of KPK.

Hills of Dir Lower represent a great timber, medicinal and aesthetic treasure in Hindukush range of Pakistan. So far, very little information exists on the ecological aspects of the forest communities and quantitative analysis of forest vegetation of the area (Ahmed *et al.,* 2009; Siddiqui *et al*., 2009). Some ethnobotanical surveys on

medicinal plants were conducted by Ali *et al*. (2007 & 2008) and Asad *et al.* (2009). However, no attention was paid to describe the altitudinal changes in forest about species composition, dominance, diversity and species richness of trees in Pakistan. The objectives of the present study were 1) to analyze the vegetation composition as per aspect and altitude, 2) to study the effect of altitude on various aspects of vegetation and 3) to find out the density, frequency and dominance of each species at different altitudes.

MATERIALS AND METHODS

Vegetation assessment

Different sampling sites were marked at different elevations from 750-2150m. Number of species and their density, frequency and cover were recorded. The altitude at each sampling site was recorded by using Geographical Positioning System (GPS).

Vegetation analysis

Random sampling design was used for the data collection in the study area (Fig. 1). The study area was divided into different elevation zones according to the altitudinal gradient having 100 m vertical distance between these zones. In each zone plots of 0.1 ha were taken for trees while for quantitative data of range species quadrates (1 m^2) were used. The quantitative aspects of vegetation like density, frequency and cover were determined by using the following formulae:

Species density

$$Density, (D) = \frac{Total\ no\ of\ individuals\ of\ species\ in\ all\ the\ sample\ plots}{Total\ no\ of\ sample\ plots\ studied}$$

Species frequency

$$Frequecy\ \%, (F) = \frac{Number\ of\ plots\ of\ occurence\ of\ a\ species}{Total\ no\ of\ plots\ used\ by\ sampling} \times 100$$

Relative density

$$\text{Relative density (RD)} = \frac{\text{Total No. of individual of a species in all plots}}{\text{Total No. of individuals of all species in all plots}} \times 100$$

Relative frequency

$$Relative\ frequency\ (RF) = \frac{Frequency\ of\ a\ species}{Total\ frequency\ of\ all\ species} \times 100$$

Species cover

$$Average\ Cover\ per\ species\ (C) = \frac{Total\ cover\ (square\ meter) of\ a\ species}{Number\ of\ plants\ of\ a\ species}$$

Relative cover

$$Relative\ Cover\ (RC) = \frac{Total\ cover\ of\ all\ plants\ of\ a\ spp.}{Total\ cover\ of\ all\ plants\ of\ all\ spp.} \times 100$$

Importance value

$$\text{Importance value} = \text{Relative density} + \text{Relative frequency} + \text{Relative coverage}$$

Importance value index (IVI)

The importance values index of each species was obtained by adding the values of relative density, relative cover and relative frequency and dividing it by three. Name of the community was assigned according to the first three dominant species (Mueller-Dombois & Ellenberg, 1974).

$$Importance\ Value\ Index\ (IVI) = \frac{Importance\ value(IV)}{3}$$

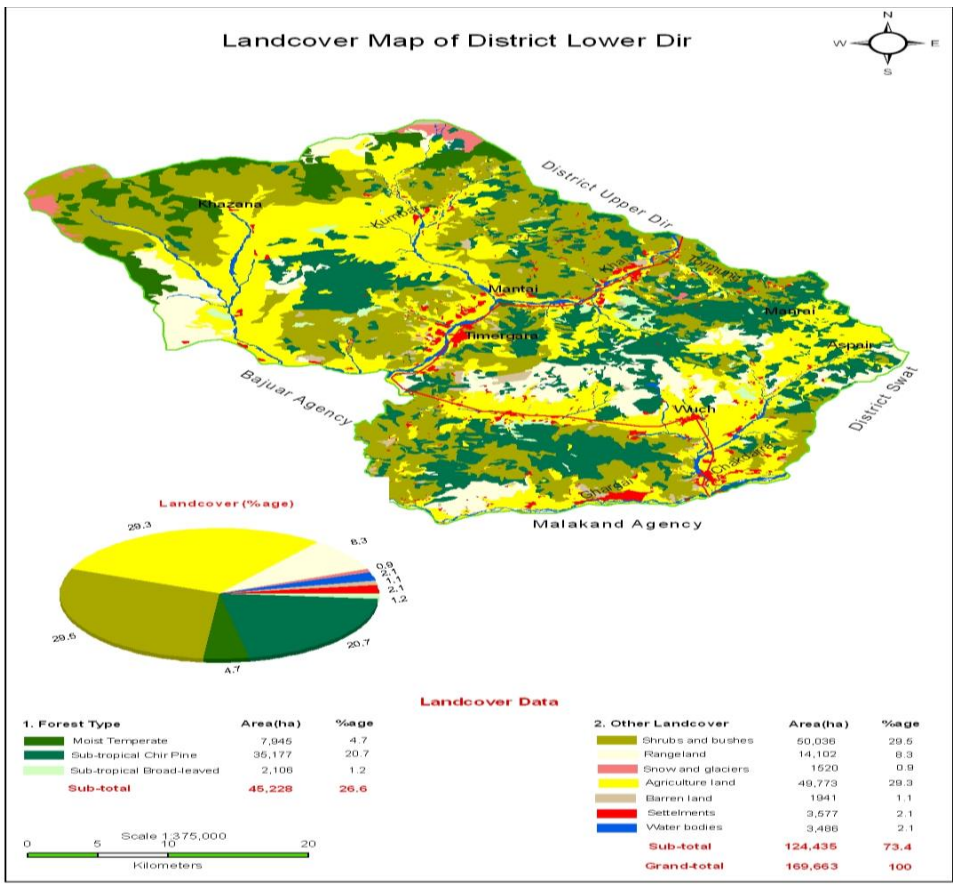

Figure 1. Map of the study area

Classification of species

Species were classified into five classes according to their abundance or percentage of stands in which they occurred as per following classification by Kafeel *et al*. (2007).

Frequency (%)	Category	Symbol
0-20	Rare	R
21-40	Occasional	O
41-60	Frequent	F
61-80	Abundant	A
81-100	Very Abundant	V.A

Statistical analysis

For statistical analysis of the data obtained in the field, MS Excel Past and sigma plot software were used. Standard deviation mean and coefficient of variance was determined at each elevation zone.

RESULTS AND DISCUSSION

Floristic composition of study area

This study was carried out from May, 2012 to August, 2013 to record floristic composition of the study area. A total of 57 plant species consisting of trees, shrubs and herbs belonging to 30 different families were identified (Table-1). Different areas of ecological zones showed similarities in term of species richness in floristic composition. The results of the present study are in agreement to the results of Ghimire *et al*. (2008) who reported 19 species (3 trees and 16 shrubs) in which *Juniperus indica* was the most dominant tree at all the elevations. Qureshi (2008) also studied density, frequency and cover during a vegetation assessment by using quadrate method and worked on finding Importance value index.

Classification of species of study area

Species were classified on the basis of their frequency (%). The study showed that *Cynodon dactylon, Aristida depressa* and *Ailanthus altissima* were the very abundant species found in the study area while *Rumex hastatus* was also abundant. Similarly, *Melia azedarach, Morus alba, Ficus carica, Pinus roxburghii and Cannabis sativa* were frequently present in the study area. Some species were occasionally present in the study area such as, *Olea ferruginea, Robinia pseudoacacia, Broussonetia papyrifera, Debregeasia salicifolia, Quercus incana, Aesculus indica, Dodonaea visosa, Adhatoda vasica* and *Silene moorcroftiana* (Table-2).

Community Dominance in Transect 1 (750 m Altitude)

A total of 24 species were found in the first transect. Out of them, *Cynodon dactylon* has the highest IVI value of 33.0 (Table-3). Then *Melia azedarach* was 2nd with IVI value of 6.35 and *Dodonaea viscosa* ranked third with value of 6.2. So the plant community of this area is *Cynodon - Melia - Dodonaea.*

Community Dominance in Transect 2 (850 m Altitude)

20 species were found in the 2nd transect. *Dodonaea viscosa* has the highest IVI value of 21. *C. dactylon* is the second dominant species with IVI value of 18.8 and *Ailanthus altissima* is the third with IVI value of 12.1. The community of this area is *Dodonaea – Cynodon – Ailanthus* (Table-3).

Community Dominance in Transect 3 (950 m Altitude)

14 species were found in the transect 3. *C. dactylon* has the highest IVI value of 37.1, followed by *M. azedarach* with an IVI value of 11.3 and *Cannabis sativa* with IVI value of 8.8, so the community of this transect is *Cynodon - Melia – Cannabis* (Table-3).

Community Dominance in Transect 4 (1050 m Altitude)

14 species were found in the transect 4. *C. dactylon* has the highest IVI value of 31.7, followed by *Aristida depressa* with IVI value of 11.8 and dominant species *C. sativa* with IVI value of 9.4, so the community of this area is *Cynodon – Aristida – Cannabis* (Table-3).

Community Dominance in Transect 5 (1150 m Altitude)

15 species were found in the transect 5; out of them *C. dactylon* has the highest IVI value of 30.9 (Table-3), followed by *A. depressa* (10.7) and *Broussonetia papyrifera* (7.6), so the community is *Cynodon – Aristida - Broussonetia.*

Community Dominance in Transect 6 (1250 m Altitude)

15 species were found in the transect 6; out of them *Cynodon dactylon* has the highest IVI value of 34.2, followed by *B. papyrifera* (9.2) and *A. depressa* (9.1), so the community is *Cynodon - Broussonetia – Aristida* (Table-3).

Community Dominance in Transect 7 (1350 m Altitude)

16 species were found in this transect out of them *C. dactylon* has the highest IVI value (33.2), followed by *Eucalyptus camaldulensis* (10.9) and *A. depressa* (10.7), so the community is *Cynodon - Eucalyptus – Aristida* (Table-3).

Community Dominance in Transect 8 (1450 m Altitude)

17 species were found in the transect 8; out of them *C. dactylon* has the highest IVI value (27.3), followed by *P. roxburghii* (19.1) and *R. hastatus* (9.4). So the community is *Cynodon - Pinus – Rumex* (Table-3).

Community Dominance in Transect 9 (1550 m Altitude)

14 species were found in the transect 9. Out of them *P. roxburghii* has the highest IVI value (26), followed by *C. dactylon* (25.5) and *R. hastatus* (8.8). So the plant community of this area is *Pinus - Cynodon – Rumex* (Table-3).

Community Dominance in Transect 10 (1650 m Altitude)

11 species were found in the transect 10. Out of them *C. dactylon* has the highest IVI value (22.9), followed by *P. roxburghii* (19) and *R. hastatus* (18.1). So the plant community of this area is *Cynodon - Pinus – Rumex* (Table-3).

Community Dominance in Transect 11 (1750 m Altitude)

15 species were found in the transect 11. Out of them *C. dactylon* has the highest IVI value of 25.4, followed by *Quercus incana* (17.3) and *R. hastatus* (13.3). So the plant community of this area is *Cynodon - Quercus – Rumex* (Table-3).

Community Dominance in Transect 12 (1850 m Altitude)

14 species were found in the transect 12. Out of them *C. dactylon* has the highest IVI value (26.2), followed by *Q. incana* (17) and *R. hastatus* (11.5). So the plant community of this area is *Cynodon - Quercus – Rumex* (Table-3).

Community Dominance in Transect 13 (1950 m Altitude)

13 species were found in the transect 13. Out of them *P. wallichiana* has the highest IVI value (26.6), followed by *C. dactylon* (19.5) and *R. hastatus* (11.5). So the plant community of this area is *Pinus - Cynodon – Rumex* (Table-3).

Community Dominance in Transect 14 (2050 m Altitude)

18 species were found in the transect 14. Out of them, *P. wallichiana* has the highest IVI value (26.1), followed by *C. dactylon* (18.9) and *R. hastatus* (10.8). So the plant community of this area is *Pinus - Cynodon – Rumex* (Table-3).

Community Dominance in Transect 15 (2150 m Altitude)

14 species were found in the transect 15. Out of them, *P. wallichiana* has the highest IVI value of 25.8. Then *C. dactylon* is the second with IVI value of 24.9 and *Aristida depressa* is the third with value of 8.3. So the plant community of this area is *Pinus - Cynodon – Aristida* (Table-3).

The present study was undertaken in Lower Dir, Khyber Pakhtunkhwa Province. The study revealed that there were a total of 57 plant species belonging to 30 families in which 25 tree species, 9 shrub species, 16 herb species and 7 grass species in the study area. The plant species were identified and documented. The dominant plant community for the individual transects and for the whole area was also identified. Species composition and vegetation type were also investigated. Plant species were classified in various categories on the

bases of plant density, frequency, plants coverage and growth habit. In study area *Cynodon dactylon* has the highest IVI value of 27.3 followed by *Aristida depressa* (7.33) and *Rumex hastatus* (6.9).

Table-1. Floristic List of Study Area

S. No.	Species	Common Name	Vegetation type	Family
1	*Melia azedarach*	Bakain	Tree	Meliaceae
2	*Ailanthus altissima*	Khara Shandai	Tree	Simaroubaceae
3	*Morus alba*	Sheh Toot	Tree	Moraceae
4	*M. nigra*	Kala Toot	Tree	Moraceae
5	*Olea ferruginea*	Khona/Olive	Tree	Oleaceae
6	*Ficus palmate*	Phagwara	Tree	Moraceae
7	*F. carica*	Inzar	Tree	Moraceae
8	*Acacia modesta*	Phulai	Tree	Fabaceae
9	*A. nilotica*	Kikar	Tree	Fabaceae
10	*Zizyphus spp.*	Ber	Tree	Rhamnaceae
11	*Robinia pseudoacacia*	Robinia	Tree	Fabaceae
12	*Zanthoxylum armatum*	Dambara/Timar	Tree	Rutaceae
13	*Eucalyptus camaldulensis*	Sufeedah	Tree	Myrtaceae
14	*Celtis australis*	Batkarar	Tree	Cannabaceae
15	*Broussonetia papyrifera*	Paper Mulberry	Tree	Moraceae
16	*Debregeasia salicifolia*	Aloojai	Tree	Urticaceae
17	*Pinus roxburghii*	Chir Pine	Tree	Pinaceae
18	*P. wallichiana*	Blue Pine	Tree	Pinaceae
19	*Quercus incana*	Sarai	Tree	Fagaceae
20	*Q. ilex*	Zagavan / Sarai	Tree	Fagaceae
21	*Punica granatum*	Jangli Anaar	Tree	Lythraceae
22	*Juglans regia*	Akhroot	Tree	Juglandaceae
23	*Aesculus indica*	Bankhor	Tree	Sapindaceae
24	*Platanus orientalis*	Chinaar	Tree	Platanaceae
25	*Cedrus deodara*	Diar	Tree	Pinaceae
26	*Dodonaea visosa*	Ghuraskay	Shrub	Sapindaceae
27	*Astragalus spp.*	Unknown	Shrub	Fabaceae
28	*Adhatoda vasica*	Baikanr	Shrub	Acanthaceae
29	*Rubus ellipticus*	Unknown	Shrub	Rosaceae
30	*Vibernum nervosum*	Guchh	Shrub	Adoxaceae
31	*Berberis lyceum*	Kashmal/Sumblu	Shrub	Berberidaceae
32	*Indigofera gerardiana*	Ghoreagay	Shrub	Fabaceae
33	*Rosa webbiana*	Unknown	Shrub	Rosaceae
34	*R. moschata*	Jangli Gulab	Shrub	Rosaceae
35	*Calotropis procera*	Spalmay	Herb	Apocynaceae
36	*Rumex hastatus*	Tarookay	Herb	Polygonaceae
37	*Artemisia scoparia*	Wormwood	Herb	Asteraceae
38	*A. gerardiana*	Tarkha	Herb	Asteraceae
39	*Silene moorcroftiana*	Kharghug	Herb	Caryophyllacea
40	*Cannabis sativa*	Bhang	Herb	Cannabaceae
41	*Rumex crispus*	Shalkhay	Herb	Polygonaceae
42	*Solanum surattense*	Kandiari	Herb	Solanaceae
43	*Chenopodium album*	Sarmay	Herb	Amaranthaceae
44	*Calamintha vulgaris*	Unknown	Herb	Lamiaceae

45	*Fragaria indica*	Wild Strawberry	Herb	Rosaceae
46	*Cnicus arvensis*	Unknown	Herb	Asteraceae
47	*Erigeron spp.*	Unknown	Herb	Asteraceae
48	*Micromaria biflora*	Unknown	Herb	Lamiaceae
49	*Echinops echinatus*	Unknown	Herb	Asteraceae
50	*Lepidium sativum*	Unknown	Herb	Brassicaceae
51	*Cynodon dactylon*	Kabal	Grass	Poaceae
52	*Saccharum spp.*	Sharghashay	Grass	Poaceae
53	*Arundo donax*	Narri	Grass	Poaceae
54	*Aristida depressa*	Mashkanay	Grass	Poaceae
55	*Alopecurus spp.*	Unknown	Grass	Poaceae
56	*Setaria viridis*	Unknown	Grass	Poaceae
57	*Cymbopogan jwarancusa*	Unknown	Grass	Poaceae

Table-2. Classification of Species

S. No.	Species	Frequency (%)	Category	Symbol
1	*Melia azedarach*	53	Frequent	F
2	*Ailanthus altissima*	82	Very Abundant	V. A
3	*Morus alba*	56	Frequent	F
4	*M. nigra*	11	Rare	R
5	*Olea ferruginea*	29	Occasional	O
6	*Ficus palmate*	4	Rare	R
7	*F. carica*	53	Frequent	F
8	*Acacia modesta*	11	Rare	R
9	*A. nilotica*	7	Rare	R
10	*Zizyphus spp.*	4	Rare	R
11	*Robinia pseudoacacia*	22	Occasional	O
12	*Zanthoxylum armatum*	11	Rare	R
13	*Eucalyptus camaldulensis*	20	Rare	R
14	*Celtis australis*	20	Rare	R
15	*Broussonetia papyrifera*	40	Occasional	O
16	*Debregeasia salicifolia*	22	Occasional	O
17	*Pinus roxburghii*	47	Frequent	F
18	*P. wallichiana*	20	Rare	R
19	*Quercus incana*	31	Occasional	O
20	*Q. ilex*	18	Rare	R
21	*Punica granatum*	20	Rare	R
22	*Juglans regia*	18	Rare	R
23	*Aesculus indica*	31	Occasional	O
24	*Platanus orientalis*	7	Rare	R
25	*Cedrus deodara*	7	Rare	R
26	*Dodonaea visosa*	27	Occasional	O
27	*Astragalus spp.*	13	Rare	R
28	*Adhatoda vasica*	29	Occasional	O
29	*Rubus ellipticus*	2	Rare	R
30	*Vibernum nervosum*	13	Rare	R
31	*Berberis lyceum*	15	Rare	R
32	*Indigofera gerardiana*	20	Rare	R
33	*Rosa webbiana*	2	Rare	R
34	*R. moschata*	2	Rare	R
35	*Calotropis procera*	16	Rare	R

36	*Rumex hastatus*	73	Abundant	A
37	*Artemisia scoparia*	7	Rare	R
38	*A. gerardiana*	4	Rare	R
39	*Silene moorcroftiana*	35	Occasional	O
40	*Cannabis sativa*	60	Frequent	F
41	*Rumex crispus*	7	Rare	R
42	*Solanum surattense*	15	Rare	R
43	*Chenopodium album*	9	Rare	R
44	*Calamintha vulgaris*	4	Rare	R
45	*Fragaria indica*	4	Rare	R
46	*Cnicus arvensis*	2	Rare	R
47	*Erigeron spp.*	2	Rare	R
48	*Micromaria biflora*	7	Rare	R
49	*Echinops echinatus*	2	Rare	R
50	*Lepidium sativum*	4	Rare	R
51	*Cynodon dactylon*	100	Very Abundant	V. A
52	*Saccharum spp.*	20	Rare	R
53	*Arundo donax*	7	Rare	R
54	*Aristida depressa*	91	Very Abundant	V. A
55	*Alopecurus spp.*	18	Rare	R
56	*Setaria viridis*	7	Rare	R
57	*Cymbopogan jwarancusa*	27	Occasional	O

Table-3. Cumulative Importance Value Indices of Species in Lower Dir Pakistan

Species	T1	T2	T3	T4	T5	T6	T7	T8	T9	T10	T11	T12	T13	T14	T15	CIVI
Melia azedarach	6.35	9.5	11.3	4.3	4.8	5.9	5.1	0	3.4	0	0	0	0	0	0	3.37667
Ailanthus altissima	6	12.1	8.7	4.6	5.6	4	2.7	3.6	3.8	5.6	5.4	5	1.6	1.4	0	4.67333
Morus alba	4.4	5.7	3.1	5.5	6.1	5.4	0	3	2.3	5.2	0	0	0	0	0	2.71333
M. nigra	0	0	1.6	3	0	0	0	1.9	0	0	0	0	0	0	0	0.43333
Olea ferruginea	2	3	0	0	0	2.7	4.5	2	0	0	0	0	0	0	0	0.94667
Ficus palmate	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.08667
F. carica	2	1.5	5.3	4.4	3.6	2.3	0	1.7	2	2.5	0	0	2.5	1.1	0	1.92667
Acacia modesta	2	1.5	0	0	0	0	0	0	0	0	0	0	0	0	0	0.23333
A. nilotica	1.9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.12667
Zizyphus spp.	1.3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.08667
Robinia pseudoacacia	1.4	2.5	0	0	4.2	2.5	0	0	0	0	0	0	0	0	0	0.70667
Zanthoxylum armatum	1.2	0.8	1.5	1.1	0	0	0	0	0	0	0	0	0	0	0	0.30667
Eucalyptus camaldulensis	3	0	0	0	0	0	10.9	3.5	0	0	0	1.5	0	0	0	1.26
Celtis australis	2	1.5	1.4	0	1	0	0	0	0	0	1.7	0	0	0	0	0.50667
Broussonetia papyrifera	0	0	4	9	7.6	9.2	0	2.3	2.3	4.3	0	0	0	0	0	2.58
Debregeasia salicifolia	0	0	0	0	7.6	6.2	2.5	1.8	0	0	0	0	0	0	0	1.20667
Pinus roxburghii	0	0	0	0	0	6	9.9	19.1	26	19	11.6	6	0	0	0	6.50667
P. wallichiana	0	0	0	0	0	0	0	0	0	0	0	0	26.6	26.1	25.8	5.23333
Quercus incana	0	0	0	0	0	0	2.5	2.9	4.9	0	17.3	17	0	0	0	2.97333
Q. ilex	0	0	0	0	0	0	0	0	0	0	0	0	5.5	5.1	2.7	0.88667
Punica granatum	0	0	0	0	0	0	2.5	0	0	4.7	3.2	1.3	0	1.1	0	0.85333
Juglans regia	0	0	0	0	0	0	0	5.2	3.6	5.9	0	0	0	0	0	0.98
Aesculus indica	0	0	0	0	0	0	0	0	0	0	5	8.1	4.8	2.5	5.6	1.73333
Platanus orientalis	0	0	0	0	0	0	2.3	1.6	1.9	0	0	0	0	0	0	0.38667
Cedrus deodara	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5.5	0.36667
Dodonaea visosa	6.2	21	0	0	0	0	5.2	5.7	0	0	0	0	0	0	0	2.54
Astragalus spp.	1.7	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0.26
Adhatoda vasica	0	0	2.6	3.1	3.8	3.5	2	0	0	0	0	0	0	0	0	1
Rubus ellipticus	0	0	0	0	0	0	0.9	0	0	0	0	0	0	0	0	0.06
Vibernum nervosum	0	0	0	0	0	0	0	0	0	0	0	0	3.3	5.4	2.1	0.72
Berberis lyceum	0	0	0	0	0	0	0	0	0	0	0	0	2.8	3.7	2.7	0.61333

Indigofera gerardiana	0	0	0	0	0	0	0	0	0	0	0	0	10.7	8.2	9	1.86
Rosa webbiana	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1	0.07333
R. moschata	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0.06667
Calotropis procera	3.4	1.5	0	2	0	0	0	0	0	0	0	0	0	0	0	0.46
Rumex hastatus	0	0	0	5.9	5.1	4	0	9.4	8.8	18.1	13.3	11.5	11.5	10.8	5	6.89333
Artemisia scoparia	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2.2	0.21333
A. geradiana	0	0	0	0	0	0	0	0	0	0	0	0	0	1.9	0	0.12667
Silene moorcroftiana	0	2	2.2	0	0	0	0	0	0	0	2.3	3.2	1.2	1.8	3.2	1.06
Cannabis sativa	4.7	5.7	8.8	9.4	0	3.6	3.8	4	4.3	6.1	0	0	0	0	0	3.36
Rumex crispus	0	0	0	0	0	0	0	0	0	0	1.6	2.1	0	0	0	0.24667
Solanum surattense	1.7	1.4	0	0	0	0	0	0	0	0	0	0	0	1.9	0	0.33333
Chenopodium album	1	1.4	0	0	0	0	0	0	0	0	0	0	0	0	0	0.16
Calamintha vulgaris	0	0	0	0	0	0	0	0	0	0	1.2	1	0	0	0	0.14667
Fragaria indica	0	0	0	0	0	0	0	0	0	0	0	0	1.2	0.1	0	0.08667
Cnicus arvensis	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0.06667
Erigeron spp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1.1	0	0.07333
Micromaria biflora	0	0	0	0	0	0	0	0	0	0	1.3	2.1	0	0	0	0.22667
Echinops echinatus	0	0	0	0	0	0	0	0	0	0	1.3	0	0	0	0	0.08667
Lepidium sativum	0	0	0	0	0.8	0.9	0	0	0	0	0	0	0	0	0	0.11333
Cynodon dactylon	33	18.8	37.1	31.7	30.9	34.2	33.2	27.3	25.5	22.9	25.4	26.2	19.5	18.9	24.9	27.3
Saccharum spp.	4.8	2.1	4.5	0	0	0	0	0	0	0	0	0	0	0	0	0.76
Arundo donax	2.2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.14667
Aristida depressa	3.9	2.7	7.7	11.8	10.7	9.1	10.7	4.5	6.7	0	7	12	8.4	6.4	8.3	7.32667
Alopecurus spp.	1.8	2.4	0	0	3.6	0	0	0	0	0	0	0	0	0	0	0.52
Setaria viridis	0	0	0	0	0	0	0	0	0	0	2.2	2.7	0	0	0	0.32667
Cymbopogan jwarancusa	0	0	0	3.9	4.3	0	0	0	4.4	5.6	0	0	0	0	0	1.21333

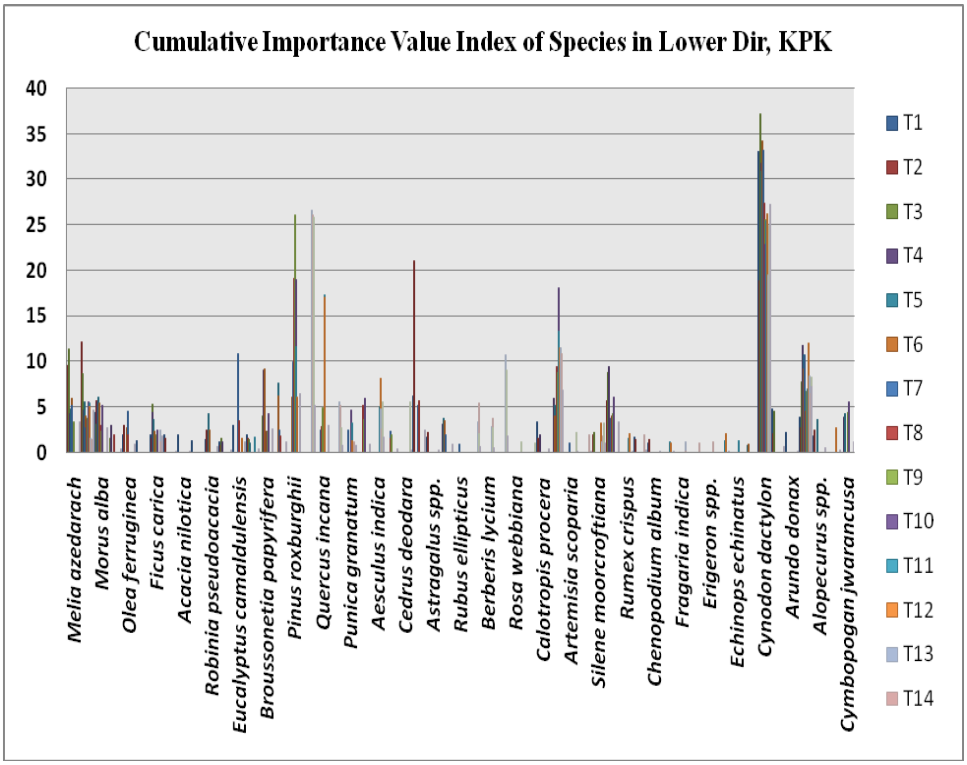

Figure 2. Cumulative Importance Value Index of species

LITERATURE CITED

Ahmed, M. 1976. Multivariate analysis of the vegetation around Skardu. Agri. Pak. 26: 177-187.

Ahmed, M., N. Khan, M. Wahab, H. Salma, F. Siddiqui, K. Nazim and U. Khan. 2009. Description and structure of *Olea ferruginea* (Royle) forests of Dir Lower District of Pakistan. Pak. J. Bot. 41(6): 2683-2695.

Ali, H., J. Shah and N. Khan. 2007. Medicinal plants of Timergara Dir valley. Int. J. Biol. Biotech., 4(2-3): 250-256.

Ali, H., J. Shah and A. K. Jan. 2008. Medicinal value of family Ranunculaceae of District Dir Pakistan. Pak. J. Bot. 39(4): 1037-1044.

Anonymous. 2006. Economic Survey of Pakistan. Finance Division, Economic Advisor's Wing, Govt. of Pak., Islamabad.

Asad, U., A. Rashid and S. Din. 2009. Ethnobotanical studies of Vascular Biodiversity in Jandool Valley District Dir (Lower). Int. J. Biol. Biotech. 6(3): 117-127.

Beg, A. R. 1975. Wildlife habitats of Pakistan. Bull, no. 5. Pak. Forest. Inst. Peshawar.

Champion, H., G. Harry and S. K. Seth. 1965. Forest types of Pakistan. Pakistan Forest Institute, Peshawar. 233 pp.

Gaston, K. J. 2000. Global patterns in biodiversity. Nature. 405(6783): 220-226.

Ghimire, S. K., O. Gimenez, R. Pradel D. McKey and Y. Aumeeruddy-Thomas. 2008. Demographic variation and population viability in a threatened Himalayan medicinal and aromatic herb *Nardostachys grandiflora*: matrix modeling of harvesting effects in two contrasting habitats. J. Applied Ecol., 45(1): 41-51.

Hussain, F. and I. Illahi. 1991. Ecology and Vegetation of Lesser Himalayan Pakistan. Bot. Dept. Uni. of. Peshawar. pp. 187.

Hussain, S. S. 1984. Pakistan Manual of Plant Ecology. National Book Foundation. Islamabad. Pp. 255.

Irshad, M., N. Khan, K. Ali and Z. Muhammad. 2016. The influence of environmental variables on *Punica granatum* L. assemblages in subtropical dry temperate woodland in the district of Lower Dir, Khyber Pakhtunkhwa, Pakistan. Turkish J. Botany, 40(6): 610-622.

Kala, C. P. and V. B. Mathur. 2002. Patterns of plant species distribution in the Trans-Himalayan region of Ladakh, India. J. Vegetat. Sci., 13(6): 751-754.

Khan, M.A., Fazli Wahid and Umm-e-Kulsoom. 2013. To investigate the major weeds of wheat in different agro-ecological zones of Khyber Pakhtunkhwa Pakistan. Pak. J. Weed Sci. Res. 19(1): 59-70.

Lan, S. 2003. Plant species diversity in Wuyishan national nature reserve. Scientia Silvae Sinicae, 29(1): 36-43.

Li, Q., L. Yang and J. Zhou. 2002. Comparative analysis on species diversity of hillcolsed afforested plant community in Beijing Jiulong Mountain. Chine. J. Applied Ecol., 13(9): 1065-1068.

Lomolino, M. V. 2001. Elevation gradients in species density: historical and prospective views. Glob. Ecol. Biogeogr., 10: 3-13.

Muhammad, Z., N. Khan, S. Ali, A. Ullah, and S.M. Khan. 2016. Density and taxonomic diversity of understory vegetation in relation to site conditions in natural stands of *Acacia modesta* in Malakand Division, Khyber Pakhtunkhwa, Pakistan. Science, 35(1): 26-34.

Qureshi, R. 2008. Vegetation assessment of Sawan Wari of Nara desert, Pakistan. Pak. J. Bot, 40(5), 1885-1895.

Rafi, M. 1965. Vegetation types of Baluchistan Province. Pak. Govt. Printing Press. Punjab. Lahore Pakistan.

Siddiqui, F. M., M. Ahmed, M. Wahab, N. Khan, M. U. Khan, N. Kanwal and S. S. Hussain. 2009. Phytosociology of Pinus roxburghii Sargent, (Chir Pine) in Lesser Himalayan and Hindukush Range of Pakistan. Pak. J. Bot. 41(5): 2357-2369.

Tang, Z., J. Fang and L. Zhang. 2004. Patterns of woody plant species diversity along environmental gradients on Mt. Taibai, Qinling Mountains. Biodiv. Sci., 12(1): 115-122.

Vetaas, O. R. and J. Grytnes. 2002. Distribution of vascular plant species richness and endemic richness along the Himalayan elevation gradient in Nepal. Glob. Ecol. Biogeogr. 11(4): 291-301.