



## STATUS STUDY OF VEGETATION AT ZABARWAN FORESTS OF KASHMIR

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**ABSTRACT**

The present study was conducted from the year 2016 to 2018 in Cheshmashahi area of Zabarwan forests of Kashmir valley. The main objective was to present the scenario of vegetational status of forest ecosystem with respect to the species importance value index (IVI) and to list the forest flora. Analysis of cumulative data revealed that this area hosts 43 families (40 Angiosperms and 3 Gymnosperms), 74 Genera (70 Angiosperms and 4 Gymnosperms) and 88 species (80 Angiosperms and 8 Gymnosperms) out of which 58 were herbs, 12 were shrubs and 18 were trees. Dicotyledons contribute about 92% of the total angiosperms observed at study site. The study site Zabarwan forests was dominated by Fabaceae family followed by Rosaceae and Poaceae. Herb species at different aspects/elevations revealed that *Sorghum halepense* revealed the most dominant species all along the altitudinal gradients. Among the shrub species *Paratiopsis jacquemontiana* revealed the highest IVI and was the most dominant species on all the altitudinal gradients/aspects. While tree species viz. *Cedrus deodara* and *Pinus roxburgii* is currently recruiting its species on the Zabarwan forests than other conifers at faster rate and may constitute a dominant climax species in future.

**KEYWORDS** : Forests, Flora, Vegetational status, Zabarwan forests.**Introduction**

Vegetation analysis is the key factor to enable us to understand the structure and functioning of an ecosystem. The vegetation analysis provides information regarding the interaction among species in a particular community as well as about the organization of the species within the community and reflects the effect on the entire environment (Billings, 1952). Vegetation analysis is important for understanding the functioning of a community with respect to the species composition, distribution, diversity, dominance and development (Bhatti *et al*, 2014). Kashmir harbours rich forest flora. Zabarwan forests (the present study area) extending over an area of 1028 hectares including Cheshmashahi, Bashiwan and Shankeracharia is one of the richest forest areas of the valley. It is located at a distance of 8 km to the South Eastern side of the Srinagar city that lies between 34°05'57" N latitude and 74°52'24" E longitude at an elevation of 1740 m asl and is serving as catchment area of the world famous Dal lake. However, for the present study, Cheshmashahi under forest cover extends over 668 hectares has been selected. Keeping the multipurpose uses of forests in view a study entitled, "Studies on Vegetational Status of Zabarwan Forests, Kashmir" was undertaken.

**Material and methods**

The phyto-sociological analysis of vegetation was carried out in the year 2016 - 2018. Main study area Cheshmashahi was divided into lower, middle and upper zones from 1730-1940, 1940-2150 and 2150-2360 m asl, respectively. At each altitude and aspect 10×10 m quadrats were defined in 20×50 m plot (Fig. 1) all the vascular plant species was recorded. Quadrats of size 1×1 m and 5×5 m were laid out randomly for herbaceous and shrub species respectively to determine frequency, density, abundance and the relative values were summed up to importance value index (IVI) following Risser and Rice (1971) and Mishra (1968). In order to express the dominance and ecological success of any species with a single value, the concept of importance value index (IVI) has been developed. The IVI is the sum of relative density, relative frequency and relative dominance and were calculated as:

$$\text{Relative Density} = \frac{\text{Density of the species}}{\text{Total density of all the species}} \times 100$$

$$\text{Relative Frequency} = \frac{\text{Frequency of the species}}{\text{Total frequency of all the species}} \times 100$$

$$\text{Relative Dominance} = \frac{\text{Basal area of the species}}{\text{Total basal area of all species}} \times 100$$

The relative density, relative frequency and relative dominance values were added to get importance value index.

**IVI** = Relative Density + Relative Frequency + Relative Dominance

**Results and Discussion:**

The contemporary study about the vegetation of Zabarwan forests revealed that the area harbours 43 families (40 Angiosperms and 3 Gymnosperms), 74 Genera (70 Angiosperms and 4 Gymnosperms) and 88 species (80 Angiosperms and 8 Gymnosperms) out of which 58 were herbs, 12 were shrubs and 18 were trees (Table 1).

In order to know the vegetational status of Zabarwan forests with respect to the species importance value index (IVI) was worked out during present study. In order to express the dominance and ecological success of any species with a single value, the concept of importance value index (IVI) has been developed (Mishra, 1968). The importance value index of herbaceous species varied on all the aspects of all the altitudinal gradients. At lower attitude of (1730-1940m asl) maximum IVI of (17.9%) was recorded in *Sorghum halepense* on South East aspect whereas minimum of (1.7%) were observed for *Iris nepalensis* and *Tribulus terrestris* on North West aspect (Fig. 2). On middle altitudinal gradient of (1940-2150 m asl) maximum IVI (14.5%) were depicted by *Artemisia absinthium* and *Taraxacum officinale* on North East aspect. On North West aspect showed minimum (1.4%) in *Nepeta catara* and *Tribulus terrestris* (Fig. 3). At upper zone (2150-2360 m asl) of North East aspect maximum IVI (16.8%) was recorded in *Sorghum halepense* while minimum IVI (2.1%) was recorded for *Hypericum perforatum*, *Lonicera quinquelocularis*, *Oxalis acetosella*, *Plantago lanceolata*, *Cynodon dactylon* and *Taraxacum officinale* North West aspect (Fig. 4). The

lowest IVI of herbaceous species may be related to the anthropogenic pressure (Mandal and Joshi, 2014)

Among the shrub species, while *Berberis lyceum* maximum IVI of 35.81% on North West aspect. *Parratiopsis jacquemontiana* displayed minimum IVI of 16.22% on South East aspect at the lower altitude range of 1730-1940 m asl (Fig. 5). At the middle altitudinal gradient of 1940-2150 m asl while maximum IVI of 46.05% was exhibited by *Parratiopsis jacquemontiana* while the minimum IVI 35.10% was recorded in *Indigofera geradiana* (Fig. 6). At the upper altitude of 2150-2360 m asl maximum IVI of 62.82% was observed in *Parratiopsis jacquemontiana* on South East aspect while minimum IVI (27.08%) was exhibited by *Ziziphus vulgaris* on North West aspect (Fig. 7). Minimum IVI of shrub species could be related to aspects and altitudinal variations (Sanglam, 2013)

As an indicator of dominance IVI has been considered the major contributor of various strata's at different aspects varied at various altitudinal gradients. Among the tree species, while maximum IVI of 57.61% was exhibited by *Cupressus torulosa* on North West aspect, the minimum IVI of 11.88% of tree species on South East aspect was exhibited by *Prunus cerasifera* at lower gradient of 1730-1940 m asl (Fig. 8). At middle altitudinal range (1940-2150 m asl) *Cedrus deodara* exhibited highest IVI of 114.75% on South East aspect (Fig.9), whereas low IVI value of 12.13% was recorded in *Aesculus indica* on North West aspect. At upper altitudinal range (2150-2360 m asl) maximum IVI of 145.64% was observed in *Cedrus deodara* on South East aspect and minimum IVI (33.48%) was exhibited by *Celtis australis* on north West aspect (Fig. 10). Our study may be attributed to the study of Mandal and Joshi (2014) who reported the lowest IVI of plant species due to anthropogenic pressure and variation in aspects.

### Conclusion

The overall result of the present investigation can be concluded as under:

- The vegetation analysis of herbs, shrubs and trees on different aspects revealed that this area hosts 43 families (40 Angiosperms and 3 Gymnosperms), 74 Genera (70

Angiosperms and 4 Gymnosperms) and 88 species (80 Angiosperms and 8 Gymnosperms) out of which 58 were herbs, 12 were shrubs and 18 were tree. Dicotyledons contribute about 92% of the total angiosperms observed at study site.

- The study site was dominated by Fabaceae family followed by Rosaceae, Poaceae, Asteraceae, Pinaceae, Caryophyllaceae, Convolvulaceae, Lamiaceae, Malvaceae, Salicaceae, Apiaceae, Cannabaceae, Oxalidaceae, Plantaginaceae and Sapindaceae. Families with representation of only one specie included Apocynaceae, Amaranthaceae, Berberidaceae, Boraginaceae, Campanulaceae, Caprifoliaceae, Chenopodiaceae, Cupressaceae, Cupuliferae, Dioscoreaceae, Hamamelidaceae, Hypericaceae, Iridaceae, Juglandaceae, Labiatae, Moraceae, Oleaceae, Ophioglossaceae, Podophyllaceae, Polygonaceae, Polypodiaceae, Porulaceae, Rhamnaceae, Sapindaceae, Thymelaeaceae, Urticeae, Violaceae and Zygophyllaceae (Table. 1).
- During the course of study fifty eight (58) species of herbs, twelve (12) species of shrubs and eighteen (18) tree species were recorded from the quadrates on different aspects of Zabarwan forests.
- The vegetation analysis of herb species at different aspects/elevations revealed that *Sorghum helepense* revealed maximum IVI and was the most dominant species all along the altitudinal gradients.
- Among the shrub species *Paratiopsis jacquemontiana* revealed the highest IVI and was the most dominant species on all the altitudinal gradients/aspects.
- The number of trees varied along the altitudinal gradient on available aspects. The vegetational analysis at different aspects/altitudes revealed that *Cupressus torulosa* was predominant on lower altitudinal range of 1730-1940 m asl while middle (1940-2150 m asl) and upper altitude (2150-2360 m asl) were dominated by *Cedrus deodara*.
- Viola odorata*, *Berberis lyceum* and *Cupressus torulosa* formed dominant plant community on lower altitude, *Artemisia absinthium* and *Taraxacum officinale*, *Paratiopsis jacquemontiana* and *Cedrus deodara* on middle altitude and *Sorghum helepense*, *Paratiopsis jacquemontiana* and *Cedrus deodara* was the principal plant association on upper altitude.

**Table 1: List of forest flora (Herbs, Shrubs and Trees) with their common names and family and life form spectra along an altitudinal gradient in Zabarwan forests.**

S. NO.	Family	Species	Common name/Vernacular name	Life form	Altitude (m asl)		
					1730-1940	1940-2150	2150-2360
1	Apiaceae	<i>Foeniculum vulgare</i>	Common fennel/Baidanii	H	+	+	-
		<i>Cuminum cyminum</i>	Cumin/Zur	H	+	+	-
2	Apocynaceae	<i>Vinca major</i>	Bigleaf periwinkle/Sada bahar	H	-	+	+
3	Asteraceae	<i>Ophioglossum vulgatum</i>	Adder's Tongue/Chonchur	H	+	+	+
		<i>Chichorium intybus</i>	Chicory/Handi posh	H	+	+	-
		<i>Taraxacum officinale</i>	Dandelion/Hand	H	+	+	+
		<i>Artemisia absinthium</i>	Worm wood/Tethwan	H	+	+	+
		<i>Tragopogon pratensis</i>	Meadow Salsify	H	-	+	+
		<i>Cardus nutans</i>	Musk thistle	H	-	+	+
4	Amaranthaceae	<i>Amaranthus cruentus</i>	Pigweed/Bustan Afroz	H	-	+	-
5	Berberidaceae	<i>Berberis lycium</i>	Indian barberry/Kawdach	S	+	+	-
6	Boraginaceae	<i>Lycopsis arvensis</i>	Small bugloss/Handi gaasi	H	-	+	-
7	Campanulaceae	<i>Campanula colorata</i>	Bell flower/Chari hakh	H	-	+	-
8	Cannabaceae	<i>Celtis australis</i>	Nettle tree/Brimji	T	+	-	+
		<i>Cannabis sativa</i>	Hemp/Bhang	H	+	+	+
9	Caprifoliaceae	<i>Lonicera quinquelocularis</i>	Translucent Honey suckle/Pakhur	H	+	+	+
10	Caryophyllaceae	<i>Dianthus angulatus</i>	Himalayan Pinks	H	+	+	-
		<i>Phytolacca acinosa</i>	Indian Poke	H	-	-	+
		<i>Lychnis coronaria</i>	Rose campion	H	-	+	+
11	Chenopodiaceae	<i>Chenopodium album</i>	Lamb's quarters/Lachij	H	+	+	-
12	Convolvulaceae	<i>Cuscuta europaea</i>	Devil's hair/Wozul kukli poot	H	+	+	-
		<i>Cuscuta cuspidata</i>	Golden thread/Kokil pot	H	-	+	-
		<i>Convolvulus arvensis</i>	Bindweed/Soi posh	H	-	+	-
13	Cupressaceae	<i>Cupressus torulosa</i>	Bhutan cypress/Sarvikul	T	+	+	-
14	Cupuliferae	<i>Quercus ilex</i>	Holm oak	T	-	+	+

15	Dioscoreaceae	<i>Dioscorea deltoidea</i>	Yam/Krisch	H	-	+	+
16	Fabaceae	<i>Robinia pseudoacacia</i>	Black locust/Kikar	T	+	+	-
		<i>Indigofera geradiana</i>	Himalayan indigo/Neel	S	+	+	-
		<i>Lespedeza cuneata</i>	Chinese bush clover	H	+	-	+
		<i>Medicago sativa</i>	Lucerne/Poshi gassi	H	+	+	-
		<i>Trifolium repens</i>	White Clover/Batak nur	H	+	-	-
		<i>Trifolium fragiferum</i>	Clover/Batak laut	H	+	+	-
		<i>Melilotus alba</i>	Sweet clover	H	-	+	-
		<i>Trigonella emodi</i>	Himalayan Fenugreek	H	-	-	+
		<i>Cytisus scoparius</i>	Common broom	S	+	+	-
17	Hamamelidaceae	<i>Parrotiopsis jacquemontiana</i>	Parrotia/Hatab	S	+	+	+
18	Hypericaceae	<i>Hypericum Perforatum</i>	Amber	H	-	-	+
19	Iridaceae	<i>Iris nepalensis</i>	Graceful himalayan iris/Mazar mond	H	+	+	+
20	Juglandaceae	<i>Juglans regia</i>	Wallnut/Doon	T	+	-	-
21	Labiatae	<i>Salvia moorcroftiana</i>	Kashmir Salvia/Sholer	H	+	+	+
22	Lamiaceae	<i>Thymus serpyllum</i>	Breckland thyme	H	+	+	+
		<i>Origanum vulgare</i>	Oregano	H	+	-	-
		<i>Nepeta cataria</i>	Cat mint/Gandi soi	H	+	+	-
23	Malvaceae	<i>Malva sylvestris</i>	Blue Mallow	H	-	+	-
		<i>Malva rotundifolia</i>	Dwarf mallow/Sochal	H	-	-	+
		<i>Peganum harmala</i>	Syrian Rue/Isband	H	+	-	-
24	Moraceae	<i>Morus alba</i>	White mulberry/Tul	T	+	+	-
25	Oleaceae	<i>Jasminum humile</i>	Yellow Jasmine	S	+	+	+
26	Ophioglossaceae	<i>Rumex orientalis</i>	Spinach dock/Jungli abuj	H	+	-	+
27	Oxalidaceae	<i>Oxalis corniculata</i>	Creeping wood sorrel/Khati buti	H	-	-	+
		<i>Oxalis acetosella</i>	Wood sorrel	H	-	-	+
28	Pinaceae	<i>Pinus helpensis</i>	Aleppo Pine	T	-	+	-
		<i>Cedrus deodara</i>	Himalayan cedar/Deodar	T	-	+	+
		<i>Pinus roxburghii</i>	Chir pine/Chir	T	-	+	-
		<i>Pinus canariensis</i>	Canary Island Pine	T	-	+	-
		<i>Pinus wallichiana</i>	Blue pine/Kail	T	-	-	+
29	Plantaginaceae	<i>Kickxia subsessilis</i>	Branched Cancerwort	H	-	+	+
		<i>Plantago lanceolata</i>	Ribwort plantain/Veuth gulla	H	-	-	+
30	Poaceae	<i>Cynodon dactylon</i>	Dürvā grass/Dramun	H	-	+	+
		<i>Panicum crusgalli</i>	Cockspur/Hama	H	+	+	-
		<i>Stipa sibirica</i>	Stipa sibirica	H	+	-	-
		<i>Eragrostis nigra</i>	Love grass	H	-	-	+
		<i>Hordeum murinum</i>	False barley/Pingi	H	-	-	+
		<i>Sorghum halepense</i>	Aleppo grass	H	+	+	+
		<i>Poa angustifolia</i>	Meadow-grass	H	-	+	+
31	Podophyllaceae	<i>Podophyllum hexandrum</i>	Himalayan mayapple/Ban vangun	H	-	+	+
32	Polygonaceae	<i>Rumex acetosa</i>	Sheep's sorrel/Choki chen	H	+	+	+
33	Polypodiaceae	<i>Adiantum capillus-veneris</i>	Adiantum/Gew theer	H	-	+	+
34	Porulaceae	<i>Portulaca oleracea</i>	Sweet beladona/Nunar	H	+	-	-
35	Rhamnaceae	<i>Ziziphus vulgaris</i>	Zizyphus/Bre	S	-	-	+
36	Rosaceae	<i>Pyrus communis</i>	Pear/Tang	T	+	+	-
		<i>Prunus cerasifera</i>	Plum/Gurdhoal	T	+	-	-
		<i>Prunus armenica</i>	Apricot/Cheer	T	+	-	-
		<i>Crataegus oxyacantha</i>	Hawthorn/Ring	S	+	-	-
		<i>Rosa webbiana</i>	Wild rose/Arwal	S	+	-	+
		<i>Rubus fruticosus</i>	Black berry/Daen Chanch	S	+	+	-
		<i>Rubus pungens</i>	Rubus oldhamii/Rang ratch	S	+	+	-
		<i>Rosa moschata</i>	Rose hip	S	+	-	+
37	Salicaceae	<i>Populus alba</i>	Silver poplar/Dodhi fres	T	+	-	-
		<i>Populus nigra</i>	Black poplar/Bati fres	T	+	-	-
		<i>Salix fragilix</i>	Brittle willow	T	+	-	-
38	Sapindaceae	<i>Aesculus indica</i>	Indian horse chestnut/Haandoon	T	+	+	-
39	Scrophulariaceae	<i>Linaria dalmatica</i>	Balkan toadflax	H	+	+	+
		<i>Verbascum Thapsus</i>	Tobacco/Wan tamook	H	+	+	-
40	Thymelaeaceae	<i>Daphne oleoides</i>	Dafne spatolata	S	-	+	+
41	Urticeae	<i>Urtica dioca</i>	Nettle/Soi	H	+	+	-
42	Violaceae	<i>Viola odorata</i>	Wood violet/Bunafshah	H	+	+	+
43	Zygophyllaceae	<i>Tribulus terretris</i>	Puncture Vine/Mister kund	H	+	+	+

T=Tree, S=Shrub, H=Herb, +=Present, -=Absent

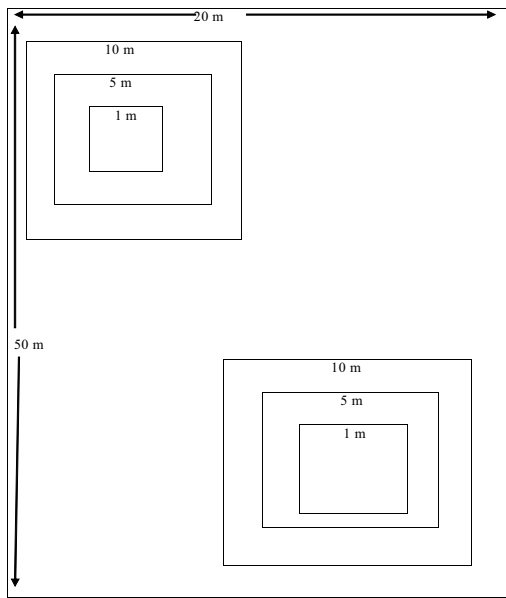


Fig. 1 : Sampling plot 20x50 meter size

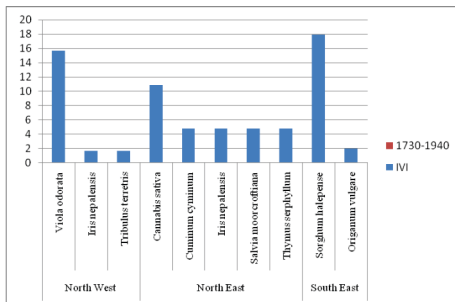


Fig 2: IVI (%) of herbaceous taxa at low zone (1730-1940 masl) of Zabarwan Forests.

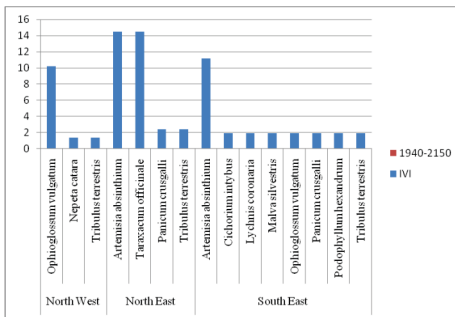


Fig 3: IVI (%) of herbaceous taxa at middle zone (1940-2150 masl) of Zabarwan Forests.

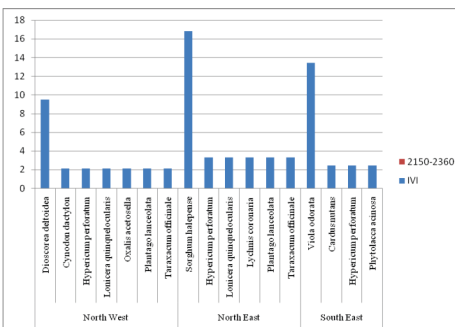


Fig 4: IVI (%) of herbaceous taxa at upper zone (2150-2360 masl) of Zabarwan Forests.

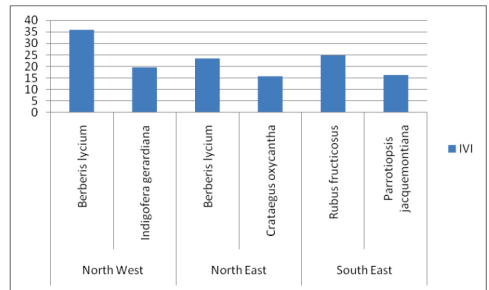


Fig 5: IVI (%) of shrub species at low zone (1730-1940 masl) of Zabarwan Forests.

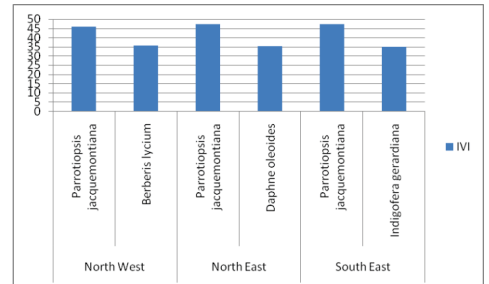


Fig 6: IVI (%) of shrub species at middle zone (1940-2150 masl) of Zabarwan Forests.

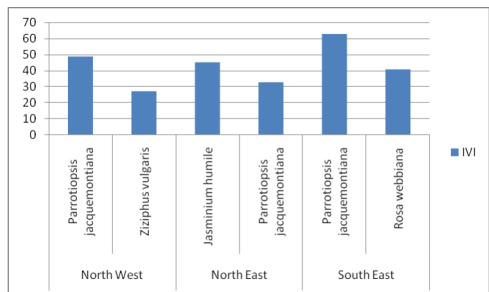


Fig7: IVI (%) of shrub species at upper zone (2150-2360 masl) of Zabarwan Forests.

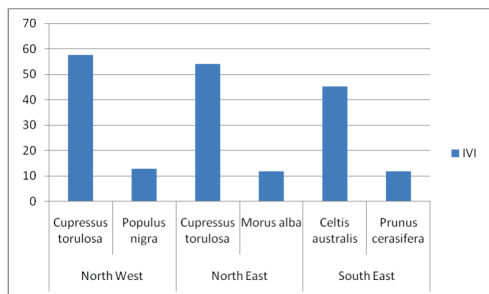


Fig 8: IVI (%) of tree species at lower zone (1730-1940 masl) of Zabarwan Forests.

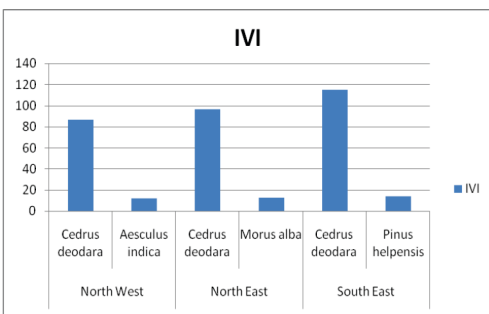
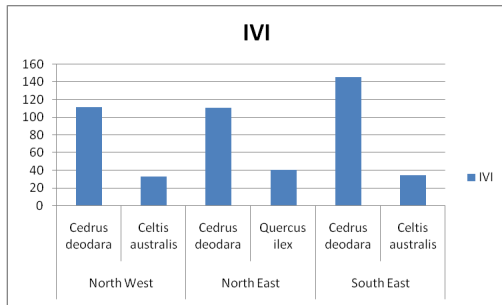


Fig 9: IVI (%) of tree species at middle zone (1940-2150 masl) of Zabarwan Forests.



**Fig 10: IVI (%) of tree species at upper zone (2150-2360 masl) of Zabarwan Forests.**

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