

STUDIES ON VEGETATIONAL STATUS (*HERBACEOUS TAXA*) OF ZABARWAN FORESTS, KASHMIR

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ABSTRACT The present study was conducted in Cheshmashahi area of Zabarwan forests of Kashmir valley during the year 2016 and 2017. The main objective was to present the scenario of vegetational status (*Herbaceous taxa*) of forest ecosystem with respect to the species composition, species diversity, species dominance, importance value index (IVI) and to list the herbaceous species. Analysis of cumulative data revealed that 58 herb species belonging to 29 families were found in Zabarwan forests. Present study revealed that flora of Zabarwan forests provides information about the total number of herbaceous species present in the forest area that could be used as a source of basic data including their identification, composition, distribution, medicinal values and their utility for the future management and conservation planning. Furthermore, there is a need to develop awareness programs to replenish this Reserve forest.

KEYWORDS : Herbaceous taxa, 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 herbaceous 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 (Herbaceous taxa) of Zabarwan Forests, Kashmir" was undertaken.

MATERIAL AND METHODS

The study was conducted during the year 2016 and 2017. Main study area Cheshmashahi was divided into lower, middle and upper zones from 1730-1940, 1940-2150 and 2150-2360 m asl, respectively. Thirty quadrats of size 1m² were laid randomly throughout the selected forest area and herbaceous vegetation was studied in terms of frequency, density, abundance and the relative values were summed up to importance value index (IVI) following Risser and Rice (1971) and Mishra (1968) respectively.

$$\text{Frequency (\%)} = \frac{\text{Total No. of quadrants in which species has occurred}}{\text{Total No. of quadrants studied}} \times 100$$

$$\text{Density (m}^{-2}\text{)} = \frac{\text{Total No. of individuals of the species}}{\text{Total No. of quadrants studied}}$$

$$\text{Abundance} = \frac{\text{Total No. of individual of species}}{\text{Total No. of quadrants in which species has occurred}}$$

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 Phyto-sociology of herbaceous flora of Zabarwan forests revealed that the area harbours about 58 species with 30 families (Table 1).

In order to know the vegetational status of herbaceous taxa of Zabarwan forests with respect to the species composition, species diversity, species dominance, importance value index (IVI) was worked out during present study (Table 2).

Frequency: Persual of data presented in Table 2, revealed that in lower altitudinal range of 1730-1940 m asl at North West aspect low frequency (10%) was recorded in *Iris nepalensis*, *Panicum crusgalli* and *Tribulus terrestris*. At the same elevation highest frequency (60%) was recorded in *Viola odorata* followed by 50% *Artemisia absinthium* and *Trifolium repens*. On North East aspect *Cuminum cyminum*, *Iris nepalensis*, *Salvia moorcroftiana*, and *Thymus serpyllum* displayed 10% low frequency while *Cannabis sativa* and *Dianthus angulatus* showed highest frequency of 50%. The frequency of herbaceous species on South East aspect was lowest (10%) for *Origanum vulgare* and highest frequency (40%) for *Cichorium intybus*, *Cuminum cyminum*, *Sorghum halepense*, *Iris nepalensis*, *Lespedeza cuneata*, *Salvia moorcroftiana*, *Stipa sibirica* and *Taraxacum officinale*.

At middle altitudinal range of 1940-2150 m asl in herbaceous species at North-West aspect showed low frequency (10%) in *Nepeta catara*, *Tragopogon pretense* and *Tribulus terrestris*. Highest frequency (50%) was recorded in *Artemisia absinthium*, *Campanula colorata* and *Taraxacum officinale*. At North East aspect low frequency (10%) was recorded in *Panicum crusgalli*, *Poa angustifolia*, *Tragopogon pretense* and *Tribulus terrestris* while high frequency (50%) was recorded in *Artemisia absinthium* and *Taraxacum officinale*. At South East aspect low frequency (10%) of herb species at same altitude range was recorded in *Cichorium intybus*, *Dioscorea deltoidea*, *Iris nepalensis*, *Iris nepalensis*, *Malva silvestris*, *Ophioglossum vulgatum*, *Panicum crusgalli*, *Podophyllum hexandrum*, *Taraxacum officinale* and *Tribulus terrestris*. The species with highest frequency (40%) included *Artemisia absinthium* and *Vinca major*.

In upper zone (2150-2360 m asl) of North West aspect (Table 2) *Hypericum perforatum*, *Linaria dalmatica*, *Lonicera quinquelocularis*, *Oxalis acetosella*, *Plantago lanceolata*, *Cynodon dactylon* and *Taraxacum officinale* showed low frequency of 10%

while highest frequency (40%) was found in *Cannabis sativa* and *Trigonella emodi*. The low frequency (10%) values on North East aspect was recorded in *Hypericum perforatum*, *Linaria dalmatica*, *Lonicera quinquelocularis*, *Lychnis coronaria*, *Plantago lanceolata*, and *Taraxacum officinale* while as high frequency (40%) was observed in *Trigonella emodi*. The species with lowest frequency (10%) included *Cardus nutans*, *Hypericum perforatum* and *Phytolacca acinosa* on South East aspect while highest frequency of 40% was recorded in *Viola odorata*.

Variation in frequency values between the range of 10% to 100% could be attributed to change in microclimate (Verma *et al*, 2005).

Density: Data presented in Table 2 shows that in lower zone (1730-1940 m asl) of North West aspect low density (0.1 m^{-2}) was recorded in *Iris nepalensis* and *Tribulus terrestris* followed by (0.2 m^{-2}) *Origanum vulgare*, *Panicum crusgalli*, *Rumex acetosa*, *Salvia moorcroftiana* and *Utrica dioica*. Maximum density (1.5 m^{-2}) on same aspect was recorded in *Ophioglossum vulgatum*. At the same zone in North East aspect lowest density (0.3 m^{-2}) was found in *Cuminum cyminum*, *Sorghum halepense*, *Iris nepalensis*, *Linaria dalmatica*, *Nepeta cataria*, *Salvia moorcroftiana*, *Thymus serpyllum*, *Tribulus terrestris* and *Verbascum Thapsus* while highest density (0.6 m^{-2}) was observed in *Cannabis sativa*, *Chenopodium album* and *Origanum vulgare*. In South East aspect low density (0.1 m^{-2}) was recorded in *Origanum vulgare* and high density of 1.5 m^{-2} was shown by *Sorghum halepense*.

The density of herbaceous species varied at middle altitudinal range of 1940-2150 m asl. *Nepeta catara* and *Tribulus terrestris* exhibited low density (0.1 m^{-2}) on North West aspect whereas high density (1.4 m^{-2}) was recorded in *Ophioglossum vulgatum*. On North East aspect minimum density (0.1 m^{-2}) was found in *Panicum crusgalli* and *Tribulus terrestris* while maximum density (0.7 m^{-2}) was recorded in *Artemisia absinthium* and *Taraxacum officinale*. The herb species with lowest density (0.1 m^{-2}) on South East aspect included *Cichorium intybus*, *Iris nepalensis*, *Malva silvestris*, *Ophioglossum vulgatum*, *Panicum crusgalli*, *Podophyllum hexandrum* and *Tribulus terrestris*. On the same aspect highest density (0.8 m^{-2}) was recorded in *Artemisia absinthium* and *Sorghum halepense*.

In upper zone (2150-2360 m asl) of North West aspect *Hypericum perforatum*, *Lonicera quinquelocularis*, *Oxalis acetosella*, *Cynodon dactylon* and *Taraxacum officinale* showed low density of 0.1 m^{-2} while high density at the same altitude (1 m^{-2}) was recorded in *Ophioglossum vulgatum*. At North East aspect low density (0.1 m^{-2}) was observed in *Hypericum perforatum*, *Lonicera quinquelocularis*, *Lychnis coronaria*, *Plantago lanceolata* and *Taraxacum officinale* and high density of 0.8 m^{-2} was recorded in *Cynodon dactylon*. The density value at South East aspect were minimum (0.1 m^{-2}) for *Cardus nutans*, *Hypericum perforatum* and *Phytolacca acinosa* while maximum density (0.7 m^{-2}) at same aspect found was in *Sorghum halepense*.

Low density in herbaceous flora may be related to aspect and altitudinal variations (Saglam, 2013).

Abundance: In lower zone (1730-1940 m asl) of North West aspect (Table 2), *Chenopodium album*, *Iris nepalensis*, *Lespedeza cuneata*, *Lonicera quinquelocularis*, *Origanum vulgare*, *Portulaca oleracea*, *Rumex acetosa*, *Salvia moorcroftiana*, *Tribulus terrestris*, *Utrica dioica* and *Verbascum Thapsus* showed low abundance (1). High abundance (7.5) was recorded in *Ophioglossum vulgatum* at the same altitude. At North East aspect low abundance (1) was recorded in *Cichorium intybus*, *Sorghum halepense*, *Dianthus angulatus*, *Linaria dalmatica*, *Nepeta cataria*, *Peganum harmala*, *Tribulus terrestris*, *Utrica dioica* and *Verbascum thapsus* while high abundance (2) at the same aspect was found in *Trifolium repens*. Low abundance (1) on South East aspect was observed in *Chenopodium album*, *Cichorium intybus*, *Lespedeza cuneata*, *Linaria dalmatica*, *Lonicera quinquelocularis*, *Medicago sativa*, *Nepeta cataria*, *Ophioglossum vulgatum*, *Origanum vulgare*, *Panicum crusgalli*, *Peganum harmala*, *Rumex orientalis*, *Thymus serpyllum*, *Tribulus terrestris* and *Verbascum thapsus* while *Sorghum halepense* showed high abundance (3.7) at lower zone of same aspect.

The abundance of the herbaceous species on North West aspect at middle altitudinal range of 1940-2150 m asl (Table 2) showed minimum abundance (1) in *Cannabis sativa*, *Cardus nutans*, *Convolvulus arvensis*, *Cuscuta europaea*, *Dianthus angulatus*, *Foeniculum vulgare*, *Iris nepalensis*, *Kickxia subsessilis*, *Linaria dalmatica*,

Lonicera quinquelocularis, *Lycopsis arvensis*, *Malva silvestris*, *Medicago sativa*, *Nepeta catara*, *Podophyllum hexandrum*, *Salvia moorcroftiana*, *Cynodon dactylon*, *Tribulus terrestris*, *Trifolium fragiferum* and *Verbascum thapsus*. Maximum abundance (2.5) on same aspect was observed in *Sorghum halepense*. At North East aspect low abundance (1) was reported in *Cannabis sativa*, *Cardus nutans*, *Convolvulus arvensis*, *Cuscuta europaea*, *Dianthus angulatus*, *Kickxia subsessilis*, *Lonicera quinquelocularis*, *Malva silvestris*, *Panicum crusgalli*, *Salvia moorcroftiana*, *Tribulus terrestris*, *Trifolium fragiferum* and *Verbascum thapsus* while maximum abundance (2.5) on same aspect was recorded in *Sorghum halepense*. The herbaceous species on South East aspect showed minimum for *Amaranthus cruentus*, *Campanula colorata*, *Cardus nutans*, *Chenopodium album*, *Cichorium intybus*, *Convolvulus arvensis*, *Cuminum cyminum*, *Dianthus angulatus*, *Dianthus angulatus*, *Foeniculum vulgare*, *Linaria dalmatica*, *Lonicera quinquelocularis*, *Iris nepalensis*, *Malva silvestris*, *Ophioglossum vulgatum*, *Panicum crusgalli*, *Podophyllum hexandrum*, *Tribulus terrestris*, *Utrica dioica*, *Verbascum thapsus* and *Vinca major* while maximum abundance (2.6) was found in *Sorghum halepense*.

The abundance of herb species varied at each aspect on upper zone (2150-2360 m asl) of North West aspect as shown in Table 2. The lowest abundance (1) was observed in *Cardus nutans*, *Hypericum perforatum*, *Kickxia subsessilis*, *Lonicera quinquelocularis*, *Oxalis corniculata*, *Oxalis acetosella*, *Plantago lanceolata*, *Poa angustifolia*, *Cynodon dactylon*, *Taraxacum officinale*, *Tragopogon pretense*, *Tribulus terrestris* and *Trigonella emodi* whereas highest abundance (2.3) was recorded in *Dioscorea deltoidea*. At North East aspect minimum abundance value of 1 was recorded in *Cardus nutans*, *Sorghum halepense*, *Hypericum perforatum*, *Kickxia subsessilis*, *Lonicera quinquelocularis*, *Lychnis coronaria*, *Oxalis corniculata*, *Plantago lanceolata*, *Taraxacum officinale*, *Tragopogon pretense*, *Tribulus terrestris* and *Trigonella emodi* while maximum abundance value of 2.6 was found in *Sorghum halepense*. The abundance herbaceous species on South East aspect showed a minimum value of 1 for *Artemisia absinthium*, *Cardus nutans*, *Eragrostis nigra*, *Hordeum murinum*, *Hypericum perforatum*, *Iris nepalensis*, *Kickxia subsessilis*, *Lespedeza cuneata*, *Linaria dalmatica*, *Lonicera quinquelocularis*, *Lychnis coronaria*, *Malva rotundifolia*, *Oxalis corniculata*, *Oxalis acetosella*, *Phytolacca acinosa*, *Plantago lanceolata*, *Poa angustifolia*, *Rumex orientalis*, *Salvia moorcroftiana*, *Cynodon dactylon*, *Tragopogon pretense*, *Tribulus terrestris*, *Trigonella emodi* and *Vinca major* to a maximum value of 2.3 for *Sorghum halepense*.

The results are in consonance with a similar study in a temperate zone of Tirthan valley of Western Himalayas. Singh (1998) reported species abundance values between the range of 1 to 11. Similarly, abundance values between the range of 1.0 to 7.8 from Kunihar forests of Himachal Pradesh was reported by Verma *et al*, 2005.

Importance Value Index (IVI): The IVI of herbaceous species varied on all the aspects of all the altitudinal gradients (Table 2). The data reveals that the IVI of these species on North West aspect at lower zone (1730-1940m asl) was minimum (1.7%) for *Iris nepalensis* and *Tribulus terrestris* while maximum IVI (15.7%) was found in *Viola odorata*. At North East aspect low IVI (4.8%) was recorded in *Cuminum cyminum*, *Iris nepalensis* and *Thymus serpyllum* and high IVI (10.9%) on same aspect was observed in *Cannabis sativa*. On South East aspect lowest IVI (4.1%) was found in *Chenopodium album*, *Lonicera quinquelocularis* and *Tribulus terrestris* while highest IVI (17.9%) was recorded in *Sorghum halepense*.

The IVI of herbaceous species at middle zone (1940-2150 m asl) on North West aspect showed minimum (1.4%) in *Nepeta catara* and *Tribulus terrestris* and maximum IVI (10.2%) was shown by *Ophioglossum vulgatum*. *Panicum crusgalli* and *Tribulus terrestris* showed minimum IVI of 2.4% at North East aspect while *Artemisia absinthium* and *Taraxacum officinale* showed maximum IVI (14.5%) at the same aspect. On South East aspect lowest IVI (1.9%) was found in *Cichorium intybus*, *Iris nepalensis*, *Malva silvestris*, *Ophioglossum vulgatum*, *Panicum crusgalli*, *Podophyllum hexandrum* and *Tribulus terrestris* while highest IVI (11.2%) was recorded in *Artemisia absinthium*.

At upper zone (2150-2360 m asl) of North West aspect showed minimum IVI (2.1%) for *Hypericum perforatum*, *Lonicera quinquelocularis*, *Oxalis acetosella*, *Plantago lanceolata*, *Cynodon dactylon* and *Taraxacum officinale*. On the same aspect maximum IVI

(9.5%) was recorded in *Dioscorea deltoidea*. At North East aspect minimum IVI (3.3%) was recorded in *Hypericum perforatum*, *Lonicera quinquelocularis*, *Lychnis coronaria*, *Plantago lanceolata* and *Taraxacum officinale* and maximum IVI (16.8%) was recorded in *Sorghum halepense*. On South East aspect lowest IVI of 2.4% was recorded in *Cardus nutans*, *Hypericum perforatum* and *Phytolacca acinosa* while highest IVI (13.4%) was recorded in *Viola odorata*.

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

CONCLUSION:

The floristic study of Zabarwan forests reveals that the area is rich in herbaceous taxa. It was the first attempt to study the vegetation status (herbaceous flora) of Zabarwan forest (Cheshmashahi) ecosystem that provides information about the total number of herbaceous species present in the forest area, their identification, composition, distribution, medicinal values and their utility but there is a need in future to explore whole flora of Zabarwan forests including Shankeracharia and Basiwan ranges. The present study can be used as a source of basic data for the future management and conservation planning. Furthermore, there is a need to develop awareness programs to replenish this Reserve forest.

Table 1: List of herbaceous species with their common names and families depicting the total taxa recorded at the studied sites of Zabarwan forests, Kashmir.

S. NO.	Family	Species	Common name/Vernacular name	Altitude			
				1730-1940	1940-2150	2150-2360	
1	Apiaceae	<i>Foeniculum vulgare</i>	Common fennel/Baidanii	+	+	-	
		<i>Cuminum cyminum</i>	Cumin/Zur	+	+	-	
2	Apocynaceae	<i>Vinca major</i>	Bigleaf periwinkle/Sada bahar	-	+	+	
3	Asteraceae	<i>Ophioglossum vulgatum</i>	Adder's Tongue/Chonchur	+	+	+	
		<i>Chichorium intybus</i>	Chicory/Handi posh	+	+	-	
		<i>Taraxacum officinale</i>	Dandelion/Hand	+	+	+	
		<i>Artemisia absinthium</i>	Worm wood/Tethwan	+	+	+	
		<i>Tragopogon pratensis</i>	Meadow Salsify	-	+	+	
		<i>Cardus nutans</i>	Musk thistle	-	+	+	
4	Amaranthaceae	<i>Amaranthus cruentus</i>	Pigweed/Bustan Afroz	-	+	-	
5	Boraginaceae	<i>Lycopsis arvensis</i>	Small bugloss/Handi gaasi	-	+	-	
6	Campanulaceae	<i>Campanula colorata</i>	Bell flower/Chari hakh	-	+	-	
7	Cannabaceae	<i>Cannabis sativa</i>	Hemp/Bhang	+	+	+	
8	Caprifoliaceae	<i>Lonicera quinquelocularis</i>	Translucent Honey suckle/Pakhur	+	+	+	
9	Caryophyllaceae	<i>Dianthus angulatus</i>	Himalayan Pinks	+	+	-	
		<i>Phytolacca acinosa</i>	Indian Poke	-	-	+	
		<i>Lychnis coronaria</i>	Rose campion	-	+	+	
10	Chenopodiaceae	<i>Chenopodium album</i>	Lamb's quarters/Lachij	+	+	-	
11	Convolvulaceae	<i>Cuscuta europaea</i>	Devil's hair/Wozul kukli poot	+	+	-	
		<i>Cuscuta cuspidata</i>	Golden thread/Kokil pot	-	+	-	
		<i>Convolvulus arvensis</i>	Bindweed/Soi posh	-	+	-	
12	Dioscoreaceae	<i>Dioscorea deltoidea</i>	Yam/Krisch	-	+	+	
13	Fabaceae	<i>Lespedeza cuneata</i>	Chinese bush clover	+	-	+	
		<i>Medicago sativa</i>	Lucerne/Poshi gassi	+	+	-	
		<i>Trifolium repens</i>	White Clover/Batak nur	+	-	-	
		<i>Trifolium fragiferum</i>	Clover/Batak laut	+	+	-	
		<i>Melilotus alba</i>	Sweet clover	-	+	-	
		<i>Trigonella emodi</i>	Himalayan Fenugreek	-	-	+	
14	Hypericaceae	<i>Hypericum ferforatum</i>	Amber	-	-	+	
15	Iridaceae	<i>Iris nepalensis</i>	Graceful himalayan iris/Mazar mond	+	+	+	
15	Labiatae	<i>Salvia moorcroftiana</i>	Kashmir Salvia/Sholer	+	+	+	
17	Lamiaceae	<i>Thymus serpyllum</i>	Breckland thyme	+	+	+	
		<i>Origanum vulgare</i>	Oregano	+	-	-	
		<i>Nepeta cataria</i>	Cat mint/Gandi soi	+	+	-	
18	Malvaceae	<i>Malva sylvestris</i>	Blue Mallow	-	+	-	
		<i>Malva rotundifolia</i>	Dwarf mallow/Sochal	-	-	+	
		<i>Peganum harmala</i>	Syrian Rue/Isband	+	-	-	
19	Ophioglossaceae	<i>Rumex orientalis</i>	Spinach dock/Jungli abuj	+	-	+	
20	Oxalidaceae	<i>Oxalis corniculata</i>	Creeping wood sorrel/Khati buti	-	-	+	
		<i>Oxalis acetosella</i>	Wood sorrel	-	-	+	
21	Plantaginaceae	<i>Kickxia subsessilis</i>	Branched Cancerwort	-	+	+	
		<i>Plantago lanceolata</i>	Ribwort plantain/Veuth gulla	-	-	+	
22	Poaceae	<i>Cynodon dactylon</i>	Dürvā grass/Dramun	-	+	+	
		<i>Panicum crusgalli</i>	Cockspur/Hama	+	+	-	
		<i>Stipa sibirica</i>	Stipa sibirica	+	-	-	
		<i>Eragrostis nigra</i>	Love grass	-	-	+	
		<i>Hordeum murinum</i>	False barley/Pingi	-	-	+	
		<i>Sorghum halepense</i>	Aleppo grass	+	+	+	
		<i>Poa angustifolia</i>	Meadow-grass	-	+	+	
23	Podophyllaceae	<i>Podophyllum hexandrum</i>	Himaliyan mayapple/Ban vangun	-	+	+	
24	Polygonaceae	<i>Rumex acetosa</i>	Sheep's sorrel/Choki chen	+	+	+	
25	Polypodiaceae	<i>Adiantum capillus-veneris</i>	Adiantum/Gew theer	-	+	+	
26	Porulaceae	<i>Portulaca oleracea</i>	Sweet beladona/Nunur	+	-	-	
27	Scrophulariaceae	<i>Linaria dalmatica</i>	Balkan toadflax	+	+	+	
		<i>Verbascum thapsus</i>	Tobacco/Wan tamook	+	+	-	
28	Urticeae	<i>Urtica dioica</i>	Nettle/Soi	+	+	-	
29	Violaceae	<i>Viola odorata</i>	Wood violet/Bunafshah	+	+	+	
30	Zygophyllaceae	<i>Tribulus terrestris</i>	Puncture Vine/Mister kund	+	+	+	

+ = Present, - = Absent

Table 2: Phyto-sociological attribute of herbaceous taxa on available aspects along altitudinal gradient at Zabarwan forests, Kashmir.

Aspect Parameter	North West				North East				South East			
	F	D	A	IVI	F	D	A	IVI	F	D	A	IVI
Species & Altitude												
1730-1940 (Lower zone)												
<i>Artemisia absinthium</i>	50	0.8	1.6	10.6	40	0.5	1.2	8.9	20	0.3	1.5	5
<i>Cannabis sativa</i>	40	0.7	1.7	8.9	50	0.6	1.2	10.9	20	0.3	1.5	5
<i>Chenopodium album</i>	30	0.3	1	5.2	40	0.6	1.5	9.7	20	0.2	1	4.1
<i>Cichorium intybus</i>	30	0.4	1.3	5.8	40	0.4	1	8	40	0.4	1	8.4
<i>Cuminum cyminum</i>	40	0.5	1.2	7.6	20	0.3	1.5	4.8	40	0.5	1.2	9.2
<i>Cuscuta europaea</i>	40	0.4	1	6.9	30	0.4	1.3	6.9	30	0.4	1.3	7.1
<i>Dianthus angulatus</i>	-	-	-	-	50	0.5	1	10	-	-	-	-
<i>Foeniculum vulgare</i>	30	0.4	1.3	5.8	30	0.4	1.3	6.9	-	-	-	-
<i>Iris nepalensis</i>	10	0.1	1	1.7	20	0.3	1.5	4.8	40	0.5	1.2	9.2
<i>Lespedeza cuneata</i>	30	0.3	1	5.2	-	-	-	-	40	0.4	1	8.4
<i>Linaria dalmatica</i>	30	0.4	1.3	5.8	30	0.3	1	6	30	0.3	1	6.3
<i>Lonicera quinquelocularis</i>	30	0.3	1	5.2	40	0.5	1.2	8.7	20	0.2	1	4.1
<i>Medicago sativa</i>	20	0.3	1.5	4.1	30	0.4	1.3	6.9	30	0.3	1	6.3
<i>Nepeta cataria</i>	20	0.5	2.5	5.4	30	0.3	1	6	30	0.3	1	6.3
<i>Ophioglossum vulgatum</i>	20	1.5	7.5	12	-	-	-	-	30	0.3	1	6.3
<i>Origanum vulgare</i>	20	0.2	1	3.4	40	0.6	1.5	9.7	10	0.1	1	2
<i>Panicum crusgalli</i>	10	0.2	2	2.3	40	0.5	1.2	8.9	30	0.3	1	6.3
<i>Peganum harmala</i>	40	0.5	1.2	7.6	40	0.4	1	8	30	0.3	1	6.3
<i>Portulaca oleracea</i>	30	0.3	1	5.2	-	-	-	-	-	-	-	-
<i>Rumex acetosa</i>	20	0.2	1	3.4	40	0.5	1.2	8.9	-	-	-	-
<i>Rumex orientalis</i>	20	0.3	1.5	4.1	30	0.4	1.3	6.9	30	0.3	1	6.3
<i>Salvia moorcroftiana</i>	20	0.2	1	3.4	20	0.3	1.5	4.8	40	0.5	1.2	9.2
<i>Sorghum halepense</i>	40	0.9	2.2	10.2	30	0.3	1	6	40	1.5	3.7	17.9
<i>Stipa sibirica</i>	30	0.7	2.3	7.8	-	-	-	-	40	0.6	1.5	10.1
<i>Taraxacum officinale</i>	40	0.6	1.5	8.2	40	0.5	1.2	8.9	40	0.6	1.5	10.1
<i>Thymus serpyllum</i>	30	0.5	1.6	6.5	20	0.3	1.5	4.8	30	0.3	1	6.3
<i>Tribulus terrestris</i>	10	0.1	1	1.7	30	0.3	1	6	20	0.2	1	4.1
<i>Trifolium fragiferum</i>	40	0.7	1.7	8.9	30	0.5	1.6	7.7	30	0.7	2.3	9.7
<i>Trifolium repens</i>	50	0.9	1.8	11.3	20	0.4	2	5.7	30	0.7	2.3	9.7
<i>Utrica dioica</i>	20	0.2	1	3.4	40	0.4	1	8	-	-	-	-
<i>Verbascum Thapsus</i>	30	0.3	1	5.2	30	0.3	1	6	20	0.2	1	4.3
<i>Viola odorata</i>	60	1.4	2.3	15.7	-	-	-	-	30	0.8	2.6	10.6
1940-2150 (Middle zone)												
<i>Adiantum capillus-veneris</i>	20	0.4	2	4.2	20	0.4	2	7.1	30	0.4	1.3	6.7
<i>Amaranthus cruentus</i>	30	0.4	1.3	5.1	-	-	-	-	20	0.2	1	3.9
<i>Artemisia absinthium</i>	50	0.7	1.4	8.7	50	0.7	1.4	14.5	40	0.8	2	11.2
<i>Campanula colorata</i>	50	0.8	1.6	9.3	40	0.6	1.5	12	20	0.2	1	3.9
<i>Cannabis sativa</i>	40	0.4	1	6	40	0.4	1	9.8	30	0.4	1.3	6.7
<i>Cardus nutans</i>	30	0.3	1	4.4	30	0.3	1	7.4	20	0.2	1	3.9
<i>Chenopodium album</i>	40	0.7	1.7	7.8	-	-	-	-	30	0.3	1	5.9
<i>Cichorium intybus</i>	40	0.5	1.2	6.6	30	0.4	1.3	8.5	10	0.1	1	1.9
<i>Convolvulus arvensis</i>	30	0.3	1	4.4	30	0.3	1	7.4	30	0.3	1	5.9
<i>Cuminum cyminum</i>	20	0.2	1	2.9	-	-	-	-	20	0.2	1	3.9
<i>Cuscuta cuspidate</i>	30	0.4	1.3	5.1	30	0.4	1.3	8.5	20	0.2	1	3.9
<i>Cuscuta europaea</i>	20	0.2	1	2.9	20	0.2	1	4.9	20	0.3	1.5	4.7
<i>Cynodon dactylon</i>	20	0.2	1	2.9	40	0.4	2	9.8	20	0.3	1.5	4.7
<i>Dianthus angulatus</i>	30	0.3	1	4.4	30	0.3	1	7.4	30	0.3	1	5.9
<i>Dioscorea deltoidea</i>	40	0.9	2.2	9	-	-	-	-	10	0.3	3	3.6
<i>Foeniculum vulgare</i>	20	0.2	1	2.9	-	-	-	-	30	0.3	1	5.9
<i>Iris nepalensis</i>	30	0.3	1	4.4	-	-	-	-	10	0.2	2	2.8
<i>Kickxia subsessilis</i>	30	0.3	1	4.4	30	0.3	1	7.4	20	0.4	2	5.6
<i>Linaria dalmatica</i>	20	0.2	1	2.9	-	-	-	-	30	0.3	1	5.9
<i>Lonicera quiquelocularis</i>	30	0.3	1	4.4	30	0.3	1	7.4	30	0.3	1	5.9
<i>Lycopsis arvensis</i>	30	0.3	1	4.4	-	-	-	-	20	0.4	2	5.6
<i>Lychnis coronaria</i>	30	0.4	1.3	5.1	-	-	-	-	10	0.1	1	1.9
<i>Malva silvestris</i>	20	0.2	1	2.9	20	0.2	1	4.9	10	0.1	1	1.9
<i>Medicago sativa</i>	20	0.2	1	2.9	-	-	-	-	30	0.4	1.3	6.7
<i>Melilotus alba</i>	20	0.3	1.5	3.6	20	0.3	1.5	6	30	0.5	1.6	7.6
<i>Nepeta catara</i>	10	0.1	1	1.4	-	-	-	-	30	0.4	1.3	6.7
<i>Ophioglossum vulgatum</i>	20	1.4	7	10.2	-	-	-	-	10	0.1	1	1.9
<i>Panicum crusgalli</i>	30	0.6	2	6.3	10	0.1	1	2.4	10	0.1	1	1.9
<i>Poa angustifolia</i>	30	0.5	1.6	5.7	10	0.2	2	3.5	30	0.4	1.3	6.7
<i>Podophyllum hexandrum</i>	20	0.2	1	2.9	-	-	-	-	10	0.1	1	1.9
<i>Rumex acetosa</i>	20	0.3	1.5	3.6	20	0.3	1.5	6	30	0.4	1.3	6.7
<i>Salvia moorcraftiana</i>	20	0.2	1	2.9	20	0.2	1	4.9	-	-	-	-
<i>Sorghum halepense</i>	20	0.5	2.5	4.8	20	0.5	2.5	8.2	30	0.8	2.6	10.1
<i>Taraxacum officinale</i>	50	0.7	1.4	8.7	50	0.7	1.4	14.5	10	0.2	2	2.8
<i>Thymus serpyllum</i>	20	0.3	1.5	3.6	20	0.3	1.5	6	-	-	-	-

<i>Tragopogon pratense</i>	10	0.2	2	2.1	10	0.2	2	3.5	30	0.5	1.6	7.6
<i>Tribulus terrestris</i>	10	0.1	1	1.4	10	0.1	1	2.4	10	0.1	1	1.9
<i>Trifolium fragiferum</i>	20	0.2	1	2.9	20	0.2	1	4.9	-	-	-	-
<i>Urtica dioica</i>	30	0.5	1.6	5.7	30	0.4	1.3	8.5	20	0.2	1	3.9
<i>Verbascum Thapsus</i>	20	0.2	1	2.9	20	0.2	1	4.9	30	0.3	1	5.9
<i>Vinca major</i>	20	0.3	1.5	3.6	20	0.3	1.5	6	40	0.4	1	7.9
<i>Viola odorata</i>	30	0.7	2.3	6.9	-	-	-	-	20	0.4	2	5.6
2150-2360 (Upper zone)												
<i>Adiantum capillus veneris</i>	30	0.4	1.3	7.1	30	0.4	1.3	11.3	30	0.4	1.3	8.6
<i>Artemisia obsinthum</i>	30	0.5	1.6	7.9	-	-	-	-	30	0.3	1	7.4
<i>Cannabis sativa</i>	40	0.5	1.2	9.2	30	0.3	1	9.9	30	0.4	1.3	8.6
<i>Cardus nutans</i>	30	0.3	1	6.3	30	0.3	1	9.9	10	0.1	1	2.4
<i>Cynodon dactylon</i>	10	0.1	1	2.1	-	-	-	-	30	0.3	1	7.4
<i>Dioscorea deltoidea</i>	30	0.7	2.3	9.5	-	-	-	-	-	-	-	-
<i>Eragrostis nigra</i>	20	0.4	2	5.8	20	0.4	2	9.3	30	0.3	1	7.4
<i>Hordeum murinum</i>	30	0.5	1.6	7.9	30	0.5	1.6	12.7	30	0.3	1	7.4
<i>Hypericum perforatum</i>	10	0.1	1	2.1	10	0.1	1	3.3	10	0.1	1	2.4
<i>Iris nepalensis</i>	30	0.4	1.3	7.1	30	0.4	1.3	11.3	20	0.2	1	4.9
<i>Kickxia subsessilis</i>	20	0.2	1	4.2	20	0.2	1	6.6	30	0.3	1	7.4
<i>Lespedeza cuneata</i>	20	0.3	1.5	5	-	-	-	-	20	0.2	1	4.9
<i>Linaria dalmatica</i>	10	0.2	2	2.9	10	0.2	2	4.6	30	0.3	1	7.4
<i>Lonicera quinquelocularis</i>	10	0.1	1	2.1	10	0.1	1	3.3	20	0.2	1	4.9
<i>Lychnis coronaria</i>	20	0.3	1.5	5	10	0.1	1	3.3	20	0.2	1	4.9
<i>Malvia rotundifolia</i>	20	0.4	2	5.8	20	0.3	1.5	8	30	0.3	1	7.4
<i>Ophioglossum vulgatum</i>	20	1	5	3.3	-	-	-	-	-	-	-	-
<i>Oxalis corniculata</i>	20	0.2	1	4.2	20	0.2	1	6.6	20	0.2	1	4.9
<i>Oxalis acetosella</i>	10	0.1	1	2.1	-	-	-	-	20	0.2	1	4.9
<i>Phytolacca acinosa</i>	30	0.4	1.3	7.1	30	0.4	1.3	11.3	10	0.1	1	2.4
<i>Plantago lanceolata</i>	10	0.1	1	2.1	10	0.1	1	3.3	30	0.3	1	7.4
<i>Poa angustifolia</i>	20	0.2	1	4.2	-	-	-	-	30	0.3	1	7.4
<i>Podophyllum hexandrum</i>	30	0.5	1.6	7.9	30	0.6	2	14	-	-	-	-
<i>Rumex acetosa</i>	30	0.6	2	8.7	-	-	-	-	-	-	-	-
<i>Rumex orientalis</i>	20	0.3	1.5	5	20	0.3	1.5	8	20	0.2	1	4.9
<i>Salvia moorcraftiana</i>	20	0.4	2	5.8	20	0.3	1.5	8	30	0.3	1	7.4
<i>Sorghum halepense</i>	30	0.6	2	8.7	30	0.8	2.6	16.8	30	0.7	2.3	12
<i>Taraxacum officinale</i>	10	0.1	1	2.1	10	0.1	1	3.3	30	0.5	1.6	9.7
<i>Thymus serpyllum</i>	20	0.3	1.5	5	-	-	-	-	20	0.4	2	7.2
<i>Tragopogon pratense</i>	20	0.2	1	4.2	20	0.2	1	6.6	20	0.2	1	4.9
<i>Tribulus terrestris</i>	30	0.3	1	6.3	30	0.3	1	9.9	20	0.2	1	4.9
<i>Trigonella emodi</i>	40	0.4	1	8.4	40	0.4	1	13.2	20	0.2	1	4.9
<i>Vinca major</i>	30	0.4	1.3	7.1	-	-	-	-	30	0.3	1	7.4
<i>Viola odorata</i>	30	0.6	2	8.7	-	-	-	-	40	0.7	1.7	13.4

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