PLANT RESOURCE EVALUATION OF CHAKESAR VALLEY, DISTRICT SHANGLA, PAKISTAN WITH RESPECT TO HUMAN AND ANIMAL USE

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By

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A thesis submitted to Department of Botany, University of Peshawar in fulfillment of the requirement for the award of degree of

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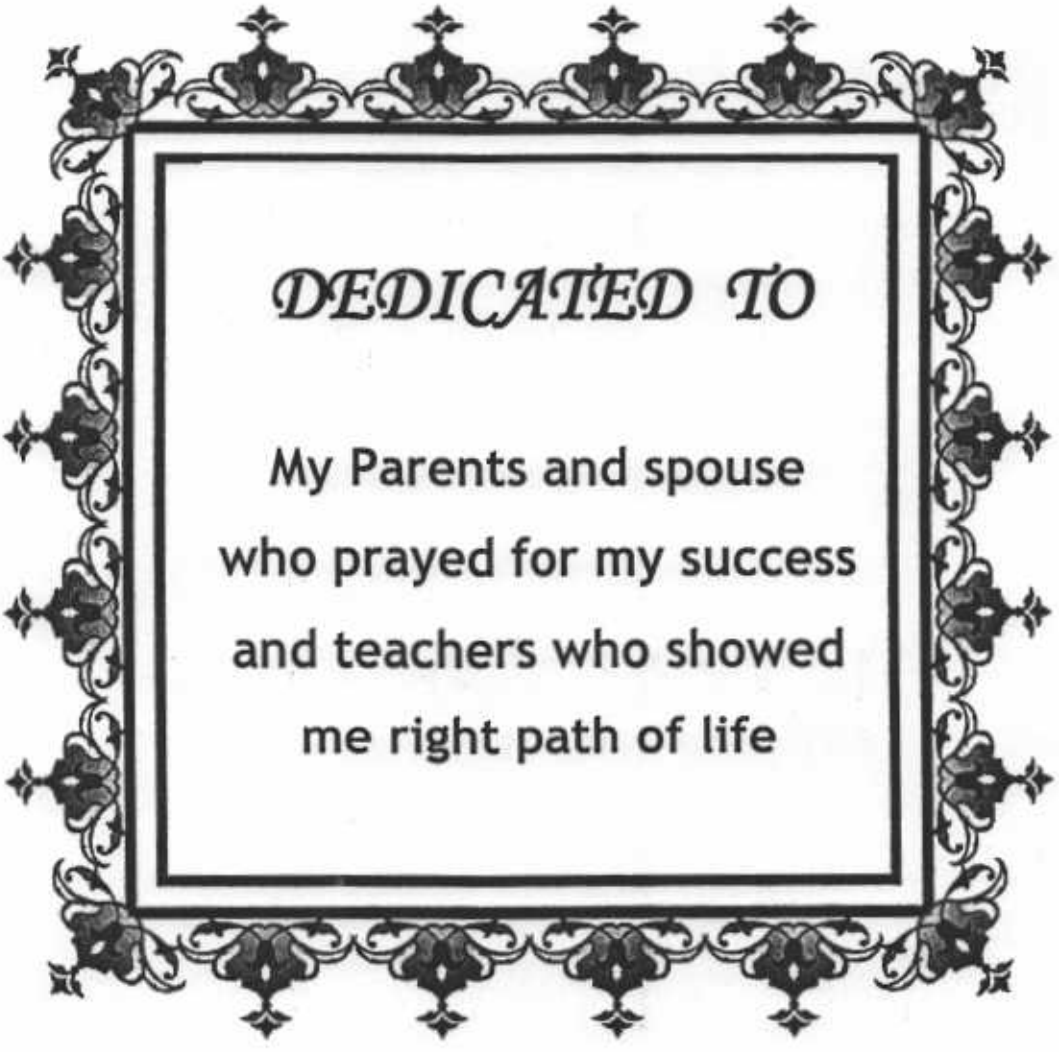
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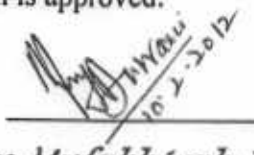
Allah

The Most Merciful and Compassionate the Most Gracious and Beneficent Whose help and guidance we always solicit at every step, at every moment.


DEDICATED TO
My Parents and spouse
who prayed for my success
and teachers who showed
me right path of life

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Mohib Shah

Vitae

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Abstract

The present research studies were aimed to evaluate plant resources of Chakesar Valley with respect to human and animal use. The study area is situated in District Shangla, Khybeer Pukhtoon Khwa, Pakistan. The area was unexplored in the past as no such work was done before. A total of 319 plant species were identified, belonging to 85 families and 215 genera. It included 75 families of dicot with 178 genera and 276 species. There were 5 families of monocot with 26 Genera and 30 species. Gymnopsperm had only one family Pinaceae with 3 genera and 5 species.

The valleys possess a rich ethnobotanical heritage as the major utilities of plants by local inhabitants showed that 164 (51.4%) medicinally used. The second major use i.e. 87 (27.3%) as fodder. These were 59(18.5%) fuel species, 47 (14.7%) timber wood, 45 (14.1%) pot herbs, 63 (19.8%) veterinary use plants. Some 180 (56.4%) plant species are visited by honey bees. The fruit yielding plants counted were 22 (6.9%) and 18 (5.6%) plants used as spice and condiments. 34 (10.6%) plants were used in agricultural appliances. Some 25(7.9%) plants are used for fencing fields while 19 (5.9%) species are used in furniture industy. The 8(2.5%) species has some mythological and superstition believes.

The locals depend on livestock for their livelihood. As such major bulk of plants is grazed. 197 (61.8%) species were palatable to various degrees. It included 50% herbs, 13.3 % shrubs and 36.7% trees. Based on taxanomic grouping there were 7.8 % monocots, 52.7 % dicotyledons 0.9 % was gymnosperms and 0.3 % pteridophyta. The individual contribution of each group to the total palatable species was 12.5% pteridophyta, 60% gymnosperms, 89.3% monocotyledons and 60.4% dicotyledons. Among the palatable species there were 32.0% highly palatable, which comprised species in the flora. Among the highly palatble 86.3% herbs, 3.9% shrubs and 9.8% trees. The less palatable species had 26% contribution, which included 47 % herbs, 26 % shrubs and 18% trees.

The vegetation of 5 different sites was sampled quantitatively. The vegetation of all sites, except Dhali, was stratified into trees, shrubs and herb layers. The edaphic and climatic factors had pronounced influence on phytodiversity.

Fourteen species were analyzed for 13 most important minerals including trace, heavy and essential metals at three phenological stages i.e. vegetative, reproductive and post reproductive stages. Trace elements or micro elements include copper, zinc, manganese, nickle, iron and sodium. The major macronutrients included

Phosphorus and Potassium. Calcium and Magnesium are considered secondary macronutrients.

In proximate analysis moisture (%), nitrogen (%), crude protein (CP), crude fibers (CF), ether extract (EE), ash, carbohydrates, hemicellulose, Neutral detergent fiber (NDF), acid detergent fiber (ADF) and nitrogen free extract (NFE) were analyzed in the same 14 plants.

Conservation status of 127 most important medicinal plants were determined in the area, it was seen that 47 (37%) species were endangered, 32 (25 %) vulnerable, 36 (28 %) rare and 12 (9%) species are infrequent.

INTRDUCTION

Plants are the producer that synthesize food and are the base of the food chain. They provide food, cover, medicines, shelter and other facilities to organisms including human. They play important role in the social and economical well being of a nation. Besides making environment pleasant they reduce soil erosion, regulate biogeochemical cycles and storehouse of genetic resource that contributes to biodiversity. The demand for plants increases worldwide as the forests area reduces so it is of utmost importance to assess the present plant resources to highlight the threats and to improve their management.

Chakesar Valley, District Shangla was a sub division of District Swat that was upgraded to District on July 1, 1995. District Shangla lies between 34^0-$31'$ to 33^0-$08'$ north latitudes and 72^0-$33'$ to 73^0-$01'$ east longitudes. In the ancient times it was known as Ghroona and its surrounding area was called Ghurband. It was called as Alpuri in ex state regime. After becoming part of Pakistan government, it was Shangla par which ultimately later became Shangla.

1.1. Location

It lies between 34^0-$31'$ to 33^0-$08'$ north latitudes and 72^0-$33'$ to 73^0-$01'$ east longitudes (Fig.1). It is surrounded by Batagram and Kala Dahka on the East, District Swat on the West, on the South by District Buner and the North by District Kohistan. The total area of the District is 1586 km^2.

1.2. History and Ethnicity

The preaching of Islam in Shangla was affected by Khushal Khan a brave General of Mehmood Ghaznavi in 1000 A.D. When Dalazak afghan a ruler of Swat, was defeated by Yousafzai Pathans in 1481. The local inhabitants were pushed into then now Hazara Division and are still residing there where they are known as Swatis. After this a number of collisions occurred successively by the Mughals, Sikhs, Britishers and none of them established a peaceful regime in Swat. When Akhund Sahib Abdul Gafoor fought his first religious war against Sikhs in 1836, the Wali dynasty started with Mian Gul Shahzada Abdul Wadood (Badshah Sahib), the first ruler in 1917. He established a stable regime. The Swat state merged with Khyber Pukhtoon Khwa in 1969 and all state employee were absorbed in government. Most of the inhabitants are Afghani, Gujar, Syed, Mian and Qureshi.

1.3. Topography

This Valley has small villages, surrounded by high mountains covered with forests. These mountains are the western extremities of the great Himalayan range.

1.4. Soil Separates

The soils have developed from deposited loess which is generally silt loam and either used for any farming or irrigated agriculture.

The area is complex showing thurst faults and tight folds, foliation and lineation. It has the world most beautiful gem variety of emerald, which mined by private agencies. The area has soap stones, chromites, marbles and many other precious stones.

1.5. Climate

Climate of the District Shangla varies in different parts due to altitudinal variation. The winter season remains cold in the upper part while remain moderate in the lower one. Rains and snowfall depend upon atmospheric condition. Snowfall starts at the beginning of the December on the peaks of the mountains. It may also occur in the late February and sometimes during middle of March. Thereafter the weather remains moderate and pleasant of the whole year. The Besham and Marthaung area remains hot in the summer. There is no meteorological station in the Shangla District. The data of temperature, precipitation and relative humidity described in the following table were recorded at the nearest station Shangla District, which is 18 km away from this location and has an altitude of 1700m.

1.6. Hydrography

Plenty of springs and streams flow through out the District as the rain last for long period in winter and summer. Four streams naming Danakol khowar, Pati khowar and Dandi khowar originating from the upper areas join to form Kanga khowar that ultimately flow into River Indus at Jadkool area. The main stream is the Ghawar-Band Kana Khowar, Etai Khowar and Kangala Khowar which flow into river Indus at Besham, Kabalgram and Jadkool, respectively.

1.7. Culture

1.7.1. Dress

People of Shangla District wear Shalwar and Kamez like other part of the Khyber Pukhtoon Khwa. The male use woolen cap in winter and a embroidered cap in

summer. The female dress consists of Shalwar, Kamiz and a dopatta. They also use chadder or burqa for pardah.

Table 1.1 **Month-wise Temperatures, Precipitation and Relative Humidity.**

Month	Mean temperature Max.	Min.	Precipitation (Millimeters)	Relative Humidity %
January	11.2	-2.4	111.4	69.7
February	12.1	-1.3	172.6	69.2
March	16.2	3.1	242.2	66.4
April	22.4	7.7	167.9	57.4
May	27.6	11.6	88.0	47.9
June	32.5	15.7	51.3	41.7
July	31.4	19.3	145.7	60.3
August	30.2	18.5	159.8	69.2
September	29.0	13.6	81.8	64.1
October	25.0	7.6	53.7	59.5
November	19.9	2.5	50.7	59.5
December	13.8	-0.9	90.7	67.4

Source: District Census Report of Shangla, July 2000.

1.7.2. Food

Roti which is made of wheat or maize flour is the most common diet of the people. They also eat meat, vegetables, fruits and milk in various forms.

1.7.3. Houses

Majority of the houses are Kacha buildings i.e. made of clay, stones and woods. A house usually consists of two or three rooms with a verandah and a boundary wall. The whole family live in just a single house or many members in a single room. Thus, a joint family system is established in this District. The male members join in a Beitak or in Hujra and exchange their views and spend time in gup shup.

1.7.4. Religion

Majority of the inhabitants are Muslims. Only few Hindu families are also residing in the Chakesar. The Muslims relate to the Hanafi school of thought.

1.7.5. Occupations

Majority of the people are illiterate and earn their living by farming in their fields. Many other are farming as tenants on the lands owned by the land lords of the area. Few are in foreign and some are government servants.

1.8. Agriculture and Forestry

Most of the local inhabitants are agriculturists. The land is very fertile but the agricultural holdings are very small as compared to the number of the owner. The main crops grown in the area are maize, wheat, barely and rice but sugar cane is very rarely grown. Vegetables like lady-finger, spinach, bean, potato, radish, turnip and peas are grown for domestic consumption. Desi ghee and honey are also great source of the people.

Table: 1.2. Some major crops by their areas and production, grown in District Shangla.

Crop	Area (in hectares)			Production (in tones)		
	Irrigated	Un-irrigated	Total	Irrigated	Un-irrigated	Total
Kharif						
Maize	1357	35598	36955	2068	35884	37952
Rice	1446	-	1446	3092	-	3092
Rabi						
Wheat	1312	16455	17767	1580	15000	16580
Barely	62	373	435	70	313	383

Source: Director Agriculture Statistics, Khyber Pukhtoon Khwa, Peshawar.

1.8.1. Horticulture

It one of the best fruits grown area where Apple, Walnut, Plum, Pear, Persimmon (Amlook), Guava and Apricot. Goojee (*Morchella*) is also naturally found in the valley in forest floors. Morchella is highly priced mushroom that sell at the rate Rs. 6000 per Kg.

1.8.2. Forestry

The valley has dense forest area. The forests are situated mainly between altitudes 1,000 to 3,000 meters above the sea level. The forests are managed by the forest department. The total area of the forests is about 98,000 acres. These forests suffer from ecological problems by climatic factors like snow, wind, light, drought

and erosion and biotic factors including grazing, browsing, lopping and cutting of plants. Torch wood extraction from pines, illicit filling, encroachment, fires and smuggling are also major threats.

Table 1.3. Area under Orchards, in District Shangla.

Fruit orchards	Area (in hectares)	Production (in tones)
Apricot	18	180
Apple	40	222
Pear	15	260
Peaches	20	202
Plum	15	142
Walnut	90	905
Persimmon	20	180

Source: Director Agriculture Statistics, Khyber Pukhtoon Khwa, Peshawar (2008).

1.8.3. Land utilization

Land use pattern of the District Shangla is given in table 1.4.

Table 1.4. Land utilization, of District Shangla

Land utilization status	Area (in hectares)
Total reported area	137442
Cultivated area	41759
Net sown area	39986
Current fallow	1773
Un-cultivated area	95683
Waste area	3860
Forest area	44407
Non available for cultivation	47416

Source: Agriculture officer Shangla/ Alpuri (2008).

1.9. Communications

1.9.1. Roads

About 127 km road is mettaled and 195 km non-mettaled road spread throughout the District. Some 40 km of Shahrah-e- Karakuram also passes through the eastern boundary of the District along Besham.

1.9.2. Telephone and Postal Offices

A number of telephone exchanges have been installed at Chakesar, Lilownai, Alpuri and Besham. Besides this two digital numbers have been allotted from Khwaza Khela telephone exchange to Shangla. There are three sub post offices and twenty branch post office situated in the District. Chakesar have one sub post office and a civil hospital.

1.10. Education

There is one intermediate college, two high schools each for boys and girls, two middle schools and four primary schools. Besides this a number of private schools and a college are also found in the Chakesar Tehsil.

1.11. Industries

A number of cottage industries of wool handicrafts. Blankets and other woolen products are produced in the houses. Besham is one the biggest trading center.

1.12. Health

Health facilities are limited in the District as there are five hospitals, 11 dispensaries, two Leprosy centers and 15 Basic Health Units.

Fig. 1 District Shangla, Location of Study Area

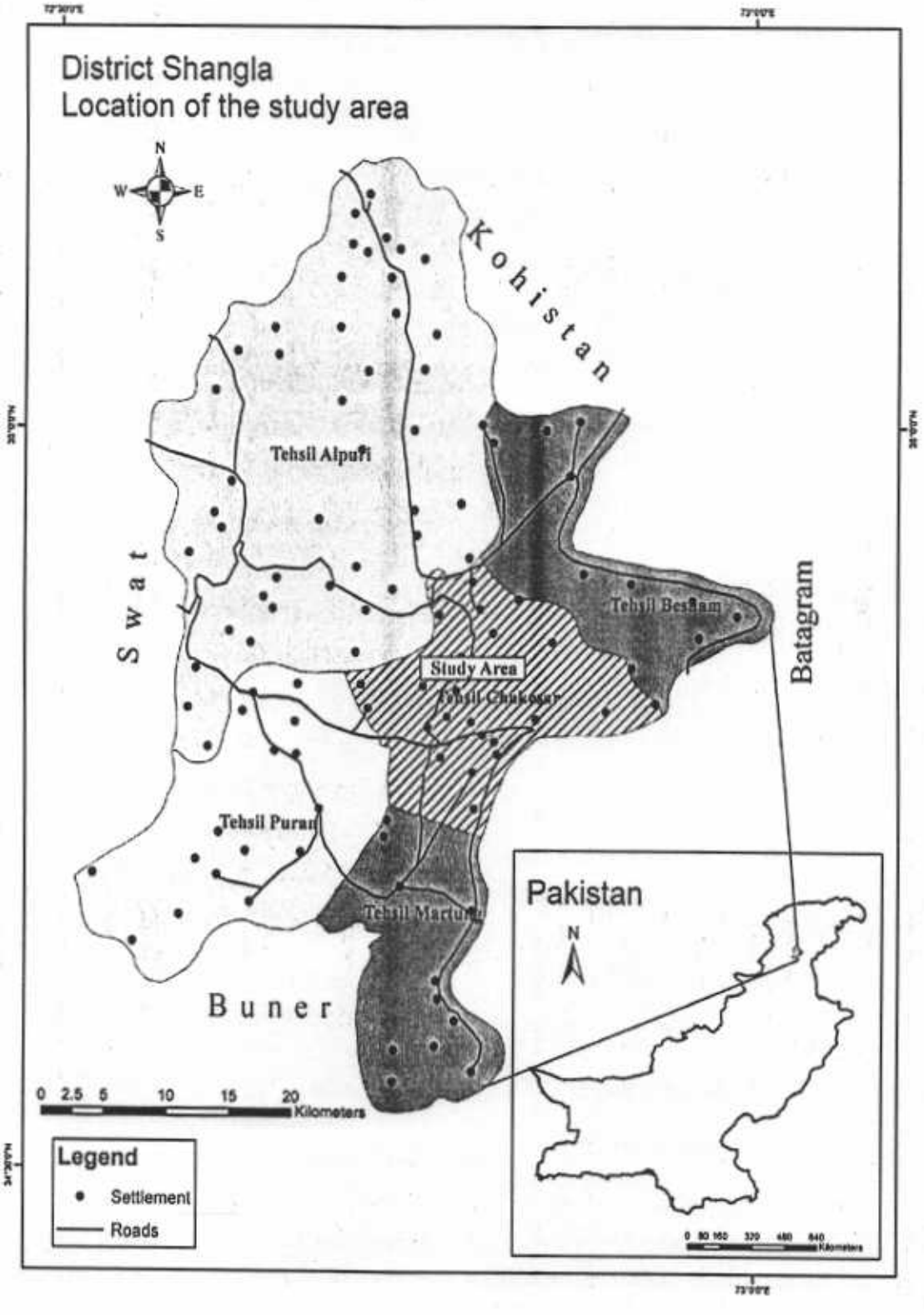


Fig. 2 Chakesar Valley, Sampled Sites.

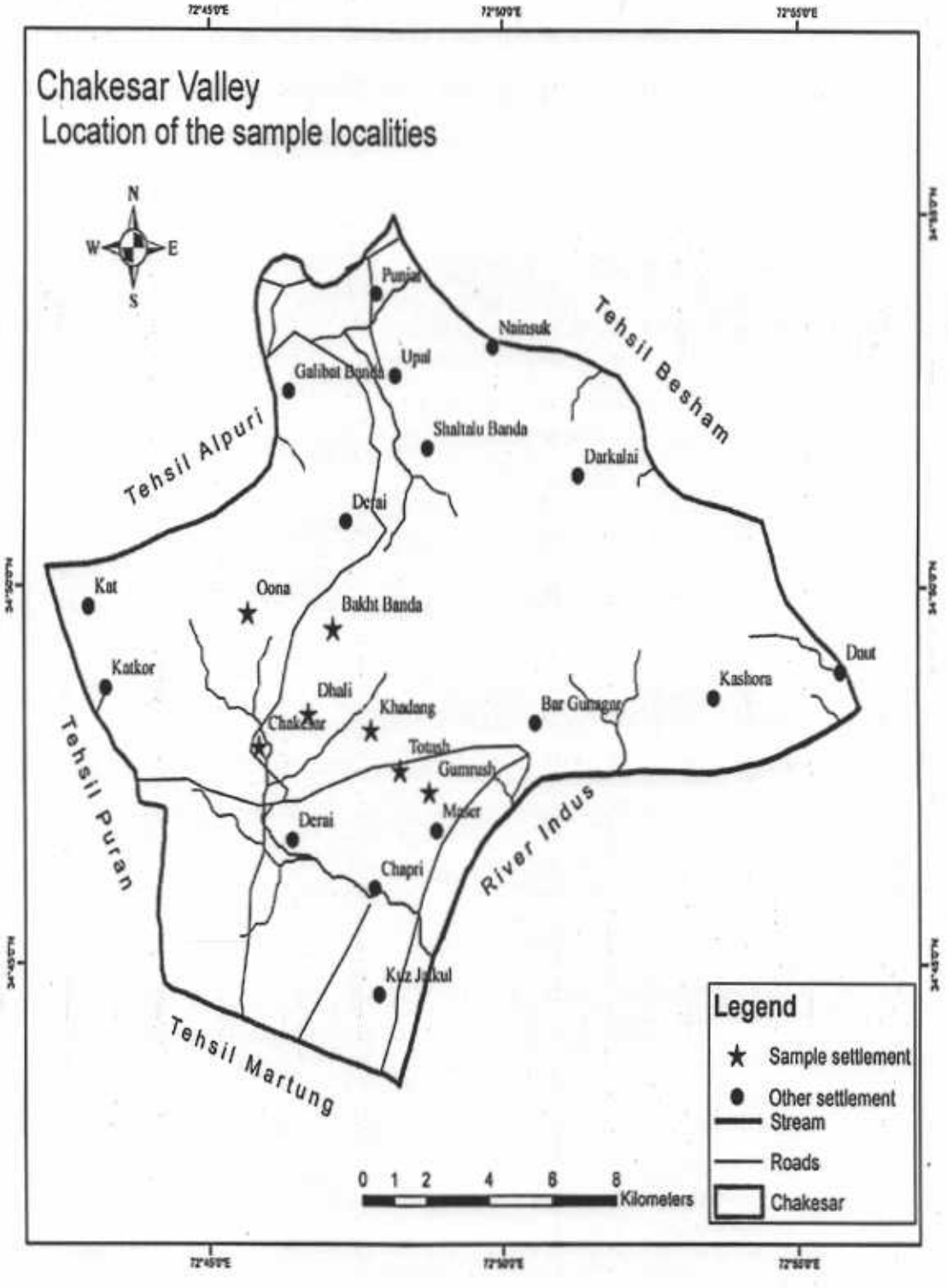
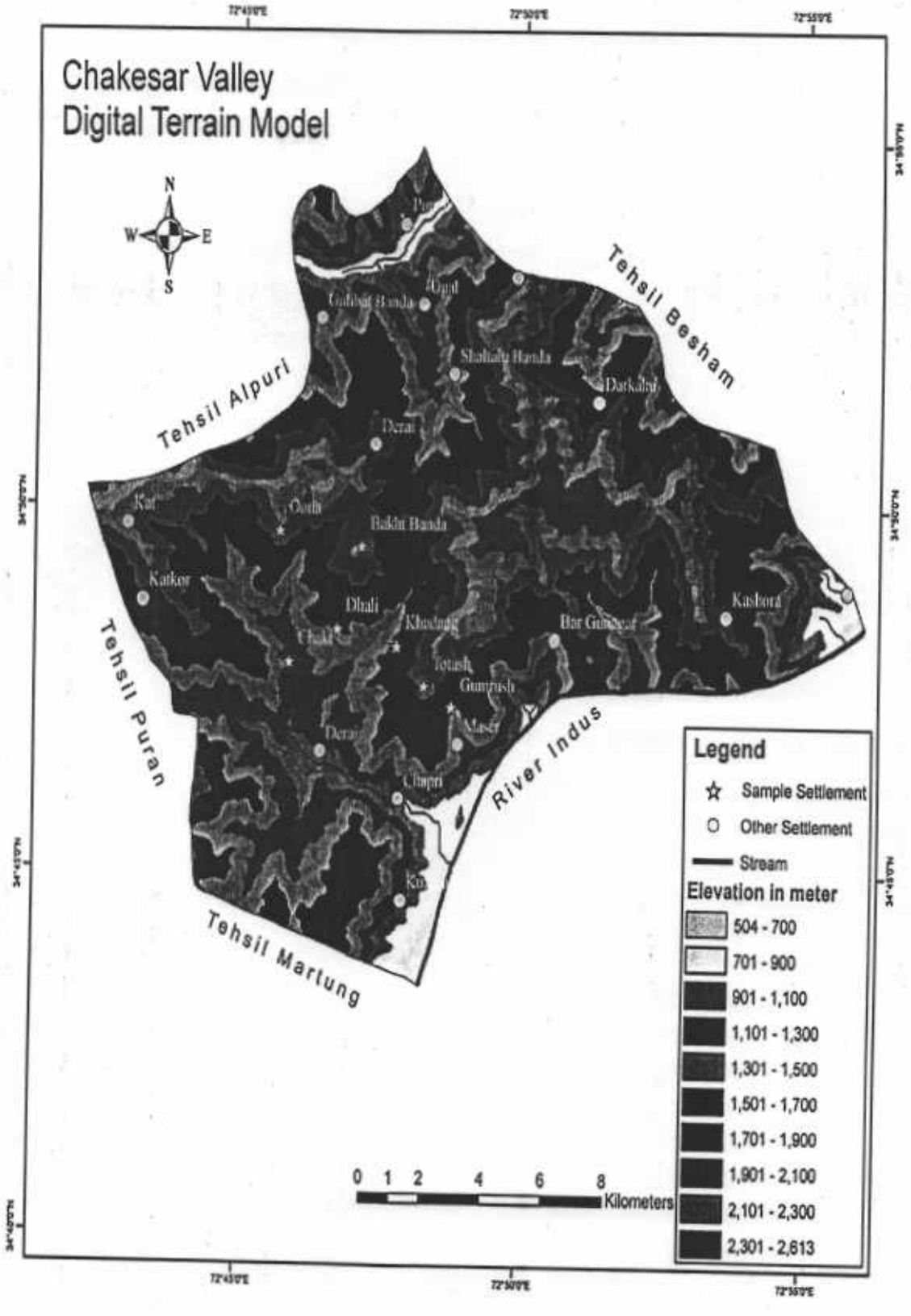


Fig. 3 Digital terrain Model of Chakesar



Aims and Objectives

Chakesar valley has a great diversity of plants but no study has been carried out in the past for biological diversity, conservation and ethno ecological informations. The present efforts were made in order to get an inventory of the flora, evaluate the plant resources and to explore the indigenous knowledge about the plants. The study is done with the aims and objectives as follows:

1. To prepare floristic list of the area.
2. To prepare ethnobotanical profile of plants.
3. To get phytosociological information of plant communities.
4. To know the vegetation status
5. To develop a correlation between edaphic factors and vegetation.
6. To chemically evaluate some of the important plants of the area.
7. To study palatability, availability and productivity of the plants.
8. To determine conservation status of vegetation of the area.

A. Floristic Diversity

Worldwide perspective of Floristic Composition

Berg *et al.*, (2000) while studying the floristic composition and phytosociological structure of a riparian forest in Itutinga, State of Minas Gerais, and Southeastern Brazil, recorded 162 species and 54 families. The forests with flora most similar to the study area were those in the same region. They suggested that rainfall and altitude strongly influenced the floristic differences among the forests compared.

Shakya *et al.*, (2000) recorded 155 plant species belonging to 130 genera and 54 families from Butwal area in Nepal. The family Leguminaceae comprised maximum number of species, i.e., 28. *Piptadenia oudhensis* an endangered plant was also reported.

Steege *et al.*, (2000) analyzed 94 plots in wet tropical South American rain forests to describe family composition and α diversity in South American rain forest. They reported that rainfall is not a good reason for tree diversity in the Amazonia area and Guiana shield. The Guiana Shield area had low diversity not due to low rainfall or low nutrient status of the soil but because of the small area of the relatively isolated rain forest area in eastern Amazonia and the Guiana Shield.

The floristic composition of the Cerrado in the Pe-de-Gigante Reserve (Santa Rita do Passa Quatro, southeastern Brazil)) consisted of 360 vascular species of to 236 genera and 69 families. Asteraceae, Fabaceae, Poaceae, and Rubiaceae were the most common families (Batalha & Mantovani, 2001).

Nebel *et al.*, (2001) described structure and floristic composition of small trees and shrubs in two flood plain forests of the lower Ucayali River, Peruvian Amazon. The soils of the two forests were nutrient rich. The average density and basal area of the under storey were 4458 ha and 5.0 m /ha, respectively. The most important tree families were Moraceae, Leguminosae, Annonaceae, Euphorbiaceae, and Lauraceae, while Violaceae, Rubiaceae, Melastomataceae, and Olacaceae are shrub families. They recorded 208 tree species in Restinga overstories and 204 in under stories. Fifty-six percent species shared between the two forest strata, while around 22% were confined to each of them. Shrubs and treelets are only present in under storey while over storey had early succession species.

Cattanio *et al.*, (2002) stated that slight topographic changes exert effects on the forests under inundation along topographic gradients. They studied variation in

floristic composition due to the inundation. The high topographic sites had high diversity of plants than low site. They suggested implementing intensive forms of agriculture.

De Souza *et al.*, (2002) analyzed the floristic composition dynamics of a secondary dense ombrophylous forest in Brazil. The silvicultural treatment was applied to obtain a rapid return to its primary conditions, or, at least, to shorten the period of time between two successive cutting cycles. The diversity had increased 0.55% by the Shannon-Weaver index, but the other indexes decreased. This indicates that a high rate of ingrowths occurred in the area, or an increase in the number of individuals is occurring at greater rates than the increase in the number of species. However, the forest structure (arboreal stratum) was greatly influenced, since the substantial increase in both number of trees and basal area suggest that the rates of recruitment and growth overcome those of mortality. Ipor *et al.* (2002) investigated the floristic composition, plant diversity, structure and physiognomy of dipterocarp forest of Mahua Crocker Range National Park Sabah. The assessment of tree species revealed that *Duabanga moluccana* tops the list of the tree species studied with respect to dominance. The least dominant species was *Xanthophyllum schizocarpum* and followed by *Baringtonia sarcostachys, Shorea maxwelliana, Alseodaphne insignis, Litsea resinosa, Beilsmedia pauciflora, Alseodaphne foxiana, Endiandra kingiana and Litsea machilifolia.*

Rana *et al.*, (2002) stated that the biological spectrum of the Tons valley Garhwal , India included phanerophytes (29.06%), nanophanerophytes (6.47%), chameophytes (2.11%), geophytes (2.64%), hydrophytes and halophytes (8.58%), therophytes (17.83%), lianas (10.43) and epiphytes (0.66%). The Raunkaier's normal spectrum showed hydro chameophytic phytoclimate. Abuodha *et al.*, (2003) while describing floristic composition, structure and distribution of coastal dune vegetation of Malindi Bay, Kenya, identified 174 plant species from 62 families. Papilionaceae with 18 species and Poaceae with 17 species were the dominant families. The most important plant species are *Halopyrum mucronatum, Ipomoea pescaprae* and *Scaevola plumieri.* The woody shrub species were *Cordia somaliensis, Pluchea discoridis* and *Tephrosia purpurea (dunensis).* Succulent herbs were also present. Ratter *et al.*, (2003) reported 951 tree species while analyzing the floristic composition of Cerrado and Amazonian Savanna, in Brazil. Clovis *et al.*, (2003) described floristic and phytosociological surveys in the Embrapa-SPSB, 48

species/morphospecies, distributed into 39 genera and 21 families Petrolina, Pernambuco, Brazil. Four phytogeoenvironments were registered based on environmental variations and floristic similarities among plots using cluster analyses. The MR environment showed the largest total density, total basal area, maximum and medium heights and maximum diameter. Moreover, it had 8.1% of plants with heights above 8 m against 0.6% for D + TL, 0.2% for DI + TL, and 0% for TS. Ferreira (2004) studied the effects of flood duration on plant species richness and floristic composition and concluded that plant species richness did not vary significantly between topographic levels, but species composition varied substantially. The species composition exhibited distinctive distribution patterns with respect to the topographic levels and river site. Gillespie *et al.,* (2004) used air born spectral, light detection and ranging sensors to determine biophysical characteristics such as floristic composition and species richness of tropical forests. Glaeser (2004) documented the floristic composition and structure of woodland community in Queen County, New York. he recorded 22 woody species of 15 genera and 13 families. Saxena *et al.*, (2004) prepared life form and leaf size spectra, leaf persistence, flowering season, and shade tolerance of trees in different vegetation within the north-western catchment of the river Gola in Kumaun Himalaya. The grassland vegetation is characterized by the largest percentage of hemicryptophytes. The flora of the whole area is therophytic. The biological spectrum for the entire Kumaun Himalaya is characterized as therohemigeophytic. The observations on leaf size indicate that with the exception of *Pinus roxburghii* forest, in all vegetation types, the species with microphylls are greater in number. In this region, the vegetation expression is evergreen, although the tree flora has a considerable content of deciduous elements. In all the forests, the flowering period in most of the trees is vernal. Wergerand & Ellenbroek (2004) described that the riverine forest formation on the levees along the Orange River in South Africa show a shift in floristic composition as the river traverses various climatic zones on its c course through the temperate area in the eastern parts of the subcontinent, the central semi-desert region, and the desert area near the Atlantic in the west. Adam & Mamat (2005) carried out study at three different altitudes in Bau to determine floristic composition and forest structure of limestone forests. They enumerated 1682 tress belonging to 129 species and 41 families. Euphorbiaceae, Moraceae, Ebenaceae, Rubiaceae and Violaceae were important families. Shannon Diversity index (H), Species richness (R) and Species evenness (E) decreased with

increasing altitude. Moraceae have the highest basal area. Some 60% to 70% of species had importance values less than 5% at all altitudes. Butler *et al.*, (2005) considered the impact of tree invasion on floristic composition of subtropical montane grasslands. Tree invasion of grasslands had substantial facilitative or antagonistic impacts on populations of many plant species. Although more than 20% of the flora showed substantial association with either grassland or forest. Forbs species composition appears to change more rapidly after tree invasion than grass species composition. Relatively few forbs preferred forest to grassland, whereas shrubs, trees or lianas were substantially more frequent in forests. Replacement of grasslands by grassy forests would reduce landscape diversity and impact on other values in the Bunya Mountains. Sasaki *et al.*, (2005) analyzed the patterns of floristic composition under different grazing intensities in the semiarid area of Bulgan, in the South Gobi, Mongolia. They reported that environmental factors such as soil moisture or landform did not affect the pattern of the floristic composition but the patterns of floristic composition were determined by grazing intensity (determined as distance from the spring) together with palatability. Visser & Both (2005) measured that how much a species should be shifting to match the change in its environment caused by climate change. They assumed that the shift in the phenology of species food abundance is, by a first approximation, an appropriate yardstick. It is clear from few examples, ranging from birds to marine plankton. In almost all of these examples, the phenology of the focal species shifts either too little (five out of 11) or too much (three out of 11) compared to the yardstick. Thus, many species are becoming mistimed due to climate change.

Morrison *et al.*, (2006) suggested that fire frequency account for about 60% of the floristic variation. Herbs and small shrubs decrease in abundance, while larger shrubs increase in abundance. They estimated the fire frequency effects on the floristic composition of 65 samples from dry sclerophyll vegetation with different fire histories in Brisbane Water, Ku-ring-gai Chase and Royal National Parks near Sydney. Haugaasen & Peres (2007) described a new study area and emphasized on the climate, forest structure, and composition and soil characteristics of flooded and unflooded forests stated that little ecological research has been carried out in the Rio Purus basin of central Amazonia, Brazil. The unflooded forests were most diverse floristically. Euphorbiaceae was the dominant family in the both types of forests.

DaCosta *et al.* (2007) surveyed flora at monthly intervals between February 2000 and June 2001 and encountered 133 species belonging to 47 families. The herbaceous/woody ratio was 1: 4. Previous data on the caatinga herbaceous flora as well as the present study indicate that the floristic richness of this biome has been underestimated and that the herbaceous/woody proportion varies according to its physiognomy and water status. De Brito *et al.*, (2007) compared the exactness of the floristic composition of the phytosociologic and volumetric analysis, using the quadrants and Prodan (1968) methods. In phytosociology both methods were used for species with higher importance index values. They concluded that Prodan is more efficient than quadrant method. Dos Santos *et al.*, (2007) determined the floristic composition and structure of dry forest in Monte Claros Muncipality. The structural parameters, density, dominancy, frequency and index of importance value were calculated. Sixty one arboreal species were classified with density of $H^{/}$ =. & J = 80 %. Encinas *et al.*, (2007) reported 742 plants belonging to 83 species, 67 genera and 38 families from Goias state. The leading dominant families were Leguminaceae, Rubiaceae, Myrtaceae, Apocynaceae and Chrysobalanaceae. Ezcurra *et al.*, (2007) investigated floristic relationship based on 369 genera of ten vegetation types with the help of correspondence analysis (CA) and ascending hierarchical clustering (AHC). The resulting ordination and classification were related to the environmental characteristics of different vegetation types. The proportion of different phylogenetic groups between the regions was also compared. The floristic similarities increased from forest to non forest vegetation and higher in coastal vegetation. Hamdy *et al.* (2007) reported floristic composition of six major historical botanic gardens that were established by the Khedive Ismail (1863 - 1879) in the second half of 19th century in Cairo city. The distribution patterns of the recorded species were also presented using the multivariate analysis techniques (classification and ordination). Klein *et al.*, (2007) while elucidating the floristic profile, identified 60 species belonging to 30 families in Ilhas, municipality of Arurangua, Santa Catarina, Brazil. Asteraceae and poaceae were the richest families. Reddy *et al.* (2007) studied the quantitative floristic inventory of three distinct tropical forest types in Similipal Biosphere Reserve in Eastern Ghats of Orissa, India. They recorded a total 549 species of flowering plants. Shannon–Wiener index (H') ranged from 4.3 to 5.46. Similarity index revealed that only 25% of floristic composition of semi-evergreen forest was similar with moist deciduous forest. Analysis of population density of tree species

across girth class interval showed that around 48.9% of individuals belong to 30-60 cm dbh. Terzioolu *et al.*, (2007) described 1024 vascular plant taxa, including 73 endemics and 105 threatened plant species of the Solakly watershed in Northeastern Turkey. Medeiros & Felfili (2007) observed that floristic composition for the regeneration layer included a total of 27 families and 49 species in the Cerrado Sensustricto in Fazenda Agua Limpa and Shannon diversity of 3, 21. Sorensen' s index showed a high floristic similarity between the regeneration layer of 2006 and the adult layer in the eight monitored periods.

Cayuela *et al.*, (2008) explored that how environmental conditions affect the performance of an organism. They evaluated the response of herbaceous communities to previous and current environmental conditions. They stated that water stress decreased alpha and beta diversity during community establishment. Jafari & Akhani (2008) reported 607 vascular plants species belonging to 329 genera and 85 families in Jehan Nama protected area located in the eastern parts of Alborz Mountains of Gulistan Province N. Iran. Some 469 species belonged to dicotyledon and 119 species to monocotyledon. Gymnosperms were represented by 6 species and pteridophytes by 13 species. Poaceae was the largest family with 53 species followed by Brassicaeae (52 species) and Lamiaceae (50 species). Lykke & Goudiaby (2008) investigated woody plants in the last existing fragment of closed gallery forest in Delta du Saloum National Park, Senegal. Constrained clustering revealed six floristically distinct sections along the transect, and these sections coincided with structural differences. The vegetation was badly affected by degradation caused by frequent and intense fires coming from the surrounding savanna and by declining precipitation. Madsen & Ilgaard (2008) reported that non-ridge forest plot at 2900 m elevation has 75 species and 28 families ha^{-1} in southern Ecuador and was believed to represent an advanced stage of succession whereas, the ridge forest plot at 2700 m had 90 species and 38 families ha^{-1} more rapid turn-over rate probably due to a more unstable environment. Peter *et al.*, (2008) investigated that how the floristic composition and species richness of grasslands has changed over the last three decades. The data revealed that floristic composition of the grasslands changed significantly during the study period, although the factor 'time' explained only a small proportion of the total variation (2.0–4.1%).

Guo *et al.*, (2009) investigated life form spectra, leaf character, and hierarchical-synusia structure in *Thuja sutchuenensis* community, The life form spectra consisted

of 73.2% phanemphyte, 18% hemicryptophyte, 6% geophyte, 2% chamaephyte, and 0.8% of annual plants. The leaf quality was mainly of papery 48. 8% and conaceous, and 36. 4%, respectively. The dominant leaf size was microphyll (60.8%), dominant leaf margin was un-entire (56.8%), and dominant leaf form was simple (86%). The *T. sutchuenensis* community had three sub-layers, i.e., tree layer, shrub layer, and herb layer, with lesser interlayer plants. Each layer was respectively composed by phanemphyte evergreen coniferophyte, broadleaf and deciduous broad-leaf plants, nanophanerophyte evergreen and deciduous broad-leaf plants, as well as hemicryptophyte, geophyte, and annual plants. Manhas *et al.* (2009) documented 162 plant species from the swamp of Doon Valley, India. Dicotyledons contributed 71%, monocotyledons 23.5% and pteridophytes 5.6%. Poaceae with 15 genera and 17 species was the most represented family. Biological spectrum showed that therophytes were the most dominating life-form of the swamp, representing high anthropogenic disturbance in the region and limited niche space for the vegetation. Abdullahi *et al.,* (2009) enlisted a total of 40 plant species belonging to 33 genera and 7 families have been identified from Yankari Game Reserve Bauchi Nigeria. Naqinezhad *et al.,* (2009) studied floristic diversity and environmental characteristics of 45 of wetland sites of the Alborz Mountains Northern Iron. They stated that wetlands proved to be of conservation importance with 310 plant taxa, including 35 endemics or subendemics.

Manhas *et al.,* (2010) reported 206 species of 159 genera and 59 families in protected ecosystems of Pathankot, Hoshiarpur and Garhshanker areas of Kandi region of Punjab. The contribution of dicotyledons, monocotyledons and pteridophytes was 77.7%, 20.4% and 1.9%, respectively. *Ipomoea* was the most dominant genus. Biological spectrum showed that therophytes (52%) were the dominant life form followed by phanerophytes (27%).

Perspective of Floristic Composition in Pakistan

Tareen & Qadir (1993) compiled a complete list of the plant species of the study area in Pakistan. Life form and leaf size spectra of the plant communities were constructed according to Raunkiaer.

Nazir & Malik (2006) stated that qualitatively nanophaneropytes were dominated in investigated area followed by therophytes, hemicryptophytes and megaphanerophytes. Geophytes were low in number. They were followed by megaphanerophytes and hemicryptophytes. Therophytes and geophytes were low in

number. Index of similarity in plant communities was slightly similar as it varied from 52.55 to 62.04. It is due to similar habitat, soil conditions percentage of phosphorus and equal amount of potassium in soil. Perveen & Hussain (2007) reported 74 plant species representing 62 genera and 34 families from Gorakh hill. Qureshi (2008a) reported136 plant species belonging to 73 genera and 44 families. There was one fern species, one gymnosperm species, 6 sedges and 25 species of Poaceae were reported. The leading plant families were Poaceae (18.3 8%), Fabaceae (8.82%), Amaranthaceae (5.15%) and Convolvulaceae, Cyperaceae (4.14% each). Qureshi (2008b) conducting floristic survey of plant biodiversity of Chotiari Wetland Complex reported 120 plant species belonging to 84 genera and 39 families. Poaceae 22 species Besides, one pteridophyte and one gymnospermic species were also discovered. Poaceae (18.33%) was the major family followed by Fabaceae (8.3 3%), Capparidaceae and Solanaceae (5% each). Qureshi & Bhatti (2008) identified 145 species from five habitats from Nara Desert, Thar. The flat habitat has the highest species richness while the crest habitat has less number of species. Mostly the vegetation is characterized by xerophytic adaptation whereas saline and wetland habitats possess halophytes and hydrophytes. The Species composition has showed differences in species richness.

Hussain *et al.* (2009) reported 69 plant species distributed among 29 families in Nurpur rangelands of District Chakwal, These included 20 species of grasses, 12 of trees, 31 of shrubs and 6 of undershrubs and herbs. Hussain & Perveen (2009) while analyzing plant biodiversity and phytosociology of the Tiko Baran, Khirthar range. 70 plant species representing 59 genera and 31 families were found. Phenological status of each species was also observed. Phytosociological aspects, life forms were determined.

Parveen *et al.* (2008) collected a total of 79 plants species including rare species from Dureji game reserve. Phenology and quantitative analysis and features were studied. They observed that grazing is one of the main threats to the vegetation.

Perspective in Khyber Pukhtoon Khwa

Badshah *et al.*, (1996) stated that summer flora of Pirghar hill consisted of 97 species which belonged to 43 families. Badshah *et al.*, (2004) documented 151 species belonging to dicotyledons and 26 monocotyledons, 8 gymnosperms, one fungus and one pteridophytes.

Sher & Khan (2007) stated that flora of Chagharzai Valley, District Buner consisted of 222 plant species belonging to 88 families. Of them, 78 families were Dicots; 7 Monocots and aa3 Pteridophytes. Gymnosperms were represented by Pinaceae only. Asteraceae had 21 species which was followed by Papilionaceae (12 spp.), Lamiaceae (10 spp.), Poaceae and Rosaceae (each with 9 spp.), Ranunculaceae (7 spp.), Moraceae (6 spp.). Each of the Amaranthaceae, Brassicaceae, Solanaceae, Apiaceae, Euphorbiaceae and Polygonaceae had 5 species. Chenopodiaceae, Mimosaceae and Papaveraceae had 4 species, while the remaining families had aa3 or less than 3 species.

Ethnobotany

The multidisciplinary science ethnobotany refers to the study of interactions between people and plants. i.e. how people interact with all aspect of the natural environment, including plants and animals, land forms, forest types and soils, among many other things (Hall & Bawa, 1993 and Martin, 2004). The term ethnoecology is now increasingly used to encompass all studies which describe the interaction of local people with the natural environment.

World Perspective of Ethnobotany

Vetrichelvan & Jegadeesan (2001) described 51 medicinal plants of 30 families, which are used as diuretic, anti-inflammatory, antirheumatic and antiarthritic in Tiruchirapalli District, Tamil Nadu, India. Toledo & Basin (2005) reported 123 of 280 species were useful as edible, medicinal and construction plants. Agra *et al.* (2007) documented medicinal and poisonous plant diversity in the flora of the Cariri of the state of Paraiba, Brazil. They reported 121 plant species of 45 families, used for medicinal purposes in which 5 species are poisonous. Ozturk *et al.* (2008) described

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Centratherum anthelmisticum., Triticum aestivum, Nigella sativa. and *Peganum harmala.* El-Darier & El- Mogaspi (2009) reported that 44 species, belonging to 28 families and 41 genera were traditionally used for medicinal and non-medicinal purposes El-Jabal El-Akhdar. The therapeutic indications attributed to the species were classified under 8 body systems. The main indications for medicinal plant use were common colds, asthma, kidney problems, skin inflammations, liver diseases and hypertension.

Rout *et al.*(2009) reported 58 plant species belonging to 34 families used in folk medicine in Mayurbhanj. Due to poor healthcare facilities and poverty, the indigenous people depend on local medicinal plants. Tetali *et al.* (2009) documented the conservation of traditional knowledge of Pairinche in Pune District Maharashtra, India. 182 plant species were used for different ailment including 28 species for dirrhoea.

Mali (2010) stated that *Cleome viscosa* possess beneficial effects as an anthelmintic, antiseptic, antiscorbutic, carminative, sudorific, febrifuge, and cardiac stimulant. Hussain *et al.*, (2010) described 88 plants species ethnobotanically from Jalalpur Jattan District Gujrat, Pakistan having medicinal uses. Verma *et al.* (2010) reviewed the recent ethno medicinal uses of *Calotropis procera,* which is used for the treatment of of fevers, rheumatism, indigestion, cough, cold, eczema, asthma, elephantiasis, nausea, vomiting and diarrhea, etc. Dahare & Jain (2010) carried out investigation in Tahsil Multai, dominated by the Korku and Gond tribes. A large number of traditional herbal healers exist belonging to the tribal community and are utilizing local plants in ethno-medicinal practices prevalent in the area. They documented 47 medicinal plant species belonging to 29 families and 45 genera. Hussain *et al.*, (2010) stated that healers in Bangladesh use medicinal plants as their primary source of medicinal formulations as rural patients are more dependent on traditional medicines for curing urinary tract infections and sexually transmitted diseases to lack of access to modern medical facilities, clinging to traditional approaches, and finally hesitancy to relate this form of illnesses in front of unknown doctors. They reported 32 plants distributed into 23 families used by the traditional healers of several districts and tribes of Bangladesh for treating, including leucorrhea, frequent urination, cloudy urination and burning sensations during urination. A total of 10 plants divided into 9 families were reported to be used against STDs like syphilis and gonorrhea. Mwafongo *et al.*, (2010) documented the use of lilioid monocots of the family Hyacinthaceae and asses

their conservation status in 15 selected districts of Malawi. Altogether, 49 geophyte, both dicot and monocot species were documented as sources of food (24%), medicine (58%) and pesticides and ornamentals (18%). *Ngari* (2010) focused on documenting most of medicinal plants used by the Ogiek community in Mau Forest Complex to facilitate conservation efforts. In total, 94 species of 46 families were identified and correlated with their medicinal qualities as indicated by informants. Amusa *et al.,* (2010) conducted to generate baseline data for the conservation and sustainable use of woody resources in Kainji Lake National Park. They documented local knowledge on uses, status and sustainable management of selected woody species. Using both ethnobotanical and quantitative ecological methods, a otal of 37 plants species belonging to 18 families were selected for ranking and prioritization scale. Family fabaceae was the dominant family in terms of number of species represented. Among the plant use categories, medicinal uses where ranked highest (38%) followed by edible plants (25%), miscellaneous purposes (24%), and construction (13%).

Perspective of Ethnobotany in Pakistan

In Pakistan work on the ethnobotany has been done which is reported as follows. Chaudhary *et al.* (2004) stated that about 5000 families in the District Swat collect various medicinal plants and consume more than 5000 tons of it in a year. Qureshi & Khan (2001) reported 25 medicinal plants belonging to 18 families from Kahuta, Rawalpindi. These were used for curing cholera, dyspepsia, fever, herpes, eczema, jaundice and other liver complaints. Durrani *et al.*,(2003) stated that 50 species of plants are used in traditional health care system in Nushki, District Chaghi or for treating stomach related disorders, cough, aphrodiasic, gonorrea, diuretic, diabetes, eye diseases, skin allergies, rashes, diarrhea, and dysentery. Most plants have multiple uses. Older especially women, appeared to be more knowledgeable. Quereshi *et al.,* (2007a) described that 26 species from District Mianwali were used for medicine, furniture and for making agricultural implements and as the food. The local community was knowledgeable about the local uses of plants but unfortunately this knowledge is declining as traditional culture is disappearing. Qureshi *et al.,* (2009) made various traditional therapeutic applications of 33 plant species belonging to 29 genera and 17 families from Sudhan Gali and Ganga Chotti Hills; district Bagh, Azad Kashmir and phonological observations. Ahmad & Hussain (2008) highlighted medicinal uses of plants by local communities. These plants are utilized for curing common ailments such as fever, cold, cough and diarrhea and also used simple herbal

tea. Hussain *et al.*, (2008) enlisted 40 species belonging to 39 genera and 32 families with economic importance of medicinal plants of Morgah Biodiversity Park, Rawalpindi. These plants are used as food, shelter, fodders, health care and other cultural purposes. However, changes in their life style of locals have declined of practice in the local use of medicinal plants. Khan (2008) reported 98 medicinal plants of Haramosh and Bugrote valleys Gilgit. The local uses include prevention and cure for rheumatism, asthma, diabetes, blood pressure, stomach problems, abdominal problems etc. The families like Lamiaceae, Asteraceae, Ranunculaceae, Apiaceae and Gentianaceae were important from medicinal point of view. Qureshi *et al.*, (2009) reported 28 species of 25 families from Southern Himalayan Mountains, Pakistan which were by the local women for treating various diseases. People still have strong faith in herbal medication and women are leading men in this respect. Qureshi *et al.*, (2009) recorded indigenous knowledge about medicinal plants of Chakwal. They reported 29 species of 25 genera and 18 families were reported used by the local people for various curing ailments. Sardar & Khan (2009) documented 102 species belonging to 93 genera and 62 families from tehsil Shakargarh, district Narowal, Pakistan, which are being used by local inhabitants for various purposes including fuel, furniture, fodder, making baskets and mats, brushing teeth, medicinal, vegetables and edible fruits.

Ethnobotany in Khyber Pukhtoon Khwa

The work on ethnobotany is summarized as follows. Badshah *et al.*, (1996) recorded that 83 species had varied local uses. They included 36 medicinal plants. The area is under severe deforestation and overgrazing pressure. Yousaf & Sajjad (2002) studied 115 plants belonging to 59 families from Razmak Valley North Waziristan. Of them, 80 plants were used for medicinal purposes, 41 as fuel wood, 42 fodder species and 15 as timber plants. Shinwari *et al.*, (2003) documented the medicinal uses of plants of Bar and Shinakai Valley, Gilgit. Some 22% plants were used for treating gastrointestinal ailments. 11% for curing bronchial and pulmonary disorders. A study by Badshah *et al.*, (2004) revealed that 187 species belonging to 66 families were traditionally used for various needs by the local. The ethnobotanical profile consisted of 40 fuel wood plants, 25 fruit plants, 23 species of vegetables, 14 timber wood species and poisonous plants.

Hussain *et al.*, (2004) collected ethnobotanical information of timber wood species from Ladha. South Waziristan, Pakistan. The inhabitants totally depend on

fuel wood and they used 26 plant species of 19 families, including 7 shrubs and 19 trees as fuel wood. Elder and illiterate people were more knowledgeable than young and educated people. Khan (2004) reported 100 species of medicinal importance from Astore valley, District Chilas.

Latif *et al.* (2003) stated that local people rely on their indigenous knowledge for collection, processing, packing, drying, marketing and consumption of various Non Timber Forest Products (NTFPs) especially mushrooms. Mushrooms,

Hamayun *et al.* (2003 a) described that the residents of Utror-Gabral Valleys of upper Swat use medicinal plants for curing diseases and also sell some of them in the local market for earning their live hood. Some 44 species are collected and marketed, 8 species of medicinal plants are endangered, 8 species are vulnerable and 8 species are rare. Bulk of these medicinal plants is used locally. Their survey showed that medicinal plant collectors include womenfolk (48.26%), men folk (27.0%) and children (24.74%). Almost 90% of these medicinal plants are sold in the local market in fresh form as the collectors are poor and needy. The percentage of losses is much higher in the storage because the collectors are unaware about the proper storage methods of these plants.

Hamayun *et al.* (2003 b) carried out an ethnobotanical survey of District Buner and stated that locals rely on medicinal plants for curing different ailments. However, recent and ever increasing dependency of locals on allopathic drugs along with industrialization, urbanization and globalization trends slowly but surely are modifying indigenous values and culture. The existing ethnobotanical knowledge of the area will not remain intact for long. In present study an effort was made to document common folk recipes of the area. Thus folk recipes used for curing 30 common diseases in the area were documented.

Hamayun *et al.* (2005) stated that Pakistan has about 6000 species of wild plants of which about 400 – 600 are considered medicinally important. Iqbal & Hamayun (2003) studied ethnobotanically valued flora of Hindukush-Himalayan region of Malam Jabba, which contained 187 plant species of ethnobotanical importance, belonging to 75 families. The plants were classified as medicinal plants (95 Spp.), agro forestry based plants (57 Spp.), vegetable and pot herb (39 Spp.), ornamental (32 Spp.) honey bee attracting (31 Spp.), agricultural tool making (32 Spp.), plants yielding edible fruits (30 Spp.), thatching and sheltering (27 Spp.) fencing and hedge plants (19 Spp.), poisonous (16 Spp.) and timber yielding plants (14 Spp.).

Ahmad *et al.*, (2004) documented 37 plant species of 23 families, which were used as traditional phytotherapies for the control and treatment of diabetes millitus. The rural inhabitants of the area classified these traditional phytotherapies on the basis of uses of various parts of plants and method of their uses. About 29 traditional phytotherapies were reported from the rural inhabitants of the area. Hamayun (2004) made an inventory of an ethnobotanical study of Swat Kohistan. The population of the region primarily depends upon plant resources for their domestic needs. It was found that 28 tree species belonging to 15 different families are utilized for multiple purposes in Swat Kohistan. *Cedrus deodara* and *Pinus wallichiana* is also exported to other parts of Pakistan and thus play a vital role in the economy of the area. Most of these tree species are also used for medicinal purposes. Hamayun *et al.*,(2004) investigated ethnobotanical profile of Utror and Gabral Valley. The inhabitants utilized 176 plant species for more than 42 domestic needs. These included 133 medicinal plants, 29 fuel wood species, 33 fodder species, 24 vegetables and pot herbs, 18 veterinary medicinal plants, 19 fruit yielding plants, 16 spices and condiments, 8 for construction and timber requirements, 10 ornamental plant species and 8 used as mouth wash (Maswak). Other miscellaneous uses of plants included aesthetics sense (1 sp.), anti lice (2 sp.), agricultural tools (8 sp.), thatching and roofing (5 sp.), baskets making (2 sp.), brooms (2 sp.), bridges (3 sp.), cosmetics (3 sp.), dye (2 sp.), dish cleaner (2 sp.), home decoration (2 sp.), feed (1 sp.), fencing (10 sp.), fish poison (2 sp.), furniture (8 sp.), honey bee attractant (8 sp), match industry (2 sp.), mythological use (6 sp.), naming (9 sp.), narcotic (3 sp.), oil (3 sp.), packing material (2 sp.), poisonous plants (6 sp.), ropes (2 sp.), anti snake and scorpion bite (5 sp.), soil binder (1 sp.), sticks/handles (3 sp.), snuff ash (1 sp.), shade tree (3 sp.), sport tools (1 sp.), tea (1 sp.) and utensil making (3 sp.). Most of the plants are used for multiple purposes. Some plants are also sold in the local markets, thus providing an additional source of income.

Latif & Shinwari (2004) described that non timber forest products produced in Pakistan are; morels, honey, fruits and nuts, vegetable, condiments and spices, mazri palm, silk cocoon, and many other. They reported 131 species. About 34% of locals are dependent on non timber forest products for income generation.

Arshad & Ahmad (2005a) reported 30 species belonging to 28 genera of 21 families of medico-botanical importance in the Galliyat areas Pakistan.

Arshad & Ahmad (2005b) also documented ethnobotanical data of 40 plant species belonging to 37 genera and 26 families from Galliyat areas Pakistan.

Ahmad *et al.* (2006) reported traditional medicinal uses of weeds from District Attock.

Hussain *et al.*, (2006) reported 67 plants belonging to 40 families with folk uses of medicinal plants.

Sher & Khan (2006) reported 87 medicinal plants belonging to 58 families Malam Jabba Valley, Swat.

Badshah & Hussain (2008) reported 20 plants species belonging to 20 genera of 18 families. Ten species used for curing woman diseases and other ten for curing different diseases in children. Barkatullah *et al.*, (2009) documented Ethnobotanical importance of 100 plants distributed over 49 families from Charkotli Hills, Batkhela District, Malakand, Pakistan. Of them 43 families are dicot, 2 monocot, 2 pteridophyta, and 1 gymnosperms. Most plants have more than one local use. Sixty-six plants were found to be medicinal species, 21 fruit and edible seed species, 18 fodders or forage species, 11 furniture species. The area is under heavy pressure of deforestation and overgrazing, which have reduced the regeneration of woody plants. Proper ecological management is required to protect the wildlife and ethnobotanical resources for the coming generations. Ali & Qaiser (2009) collected ethnobotanical information regarding the various indigenous uses, especially the medicinal plants in Chitral valley. A total of 83 taxa are reported as being used locally for various purposes. They suggested that roots were the major plant part used in most of the recipes. Majority of the recipes are prepared in the form of decoction from freshly collected plant parts. Mostly a single species is used and are mainly taken orally.

Adnan *et al.*, (2010) documented over 300 plant species of which majority plants species are reported to be medicinal. The local community prepares traditional medicines from these plants for curing variety of disease. Decrease in medicinal plants has been observed in the last 30 years due to various threats and issues.

Phytosociology and Vegetation Structure

Phytosociology deals with the vegetation structure, analysis, synthesis and grouping of plant communities. It is useful to collect such data to describe the population dynamics of each species and how they relate to other species in the same community. It also describes soil-plant relationship and generates data on spatial and temporal variation in variable nutrients.

World Wide Perspective of Phytosociology

Papanastasis *et al.* (2000) while studying the vegetation diversity of grazed and ungrazed rangeland in Turkey. They stated that closed rangeland had greater plant diversity and growth. The vegetation types dependant on soil texture, physiographic features, soil depth and soil chemical characteristics.

Hamzaoolu & Aksoy (2001) stated that Central Anatolia belongs to the Irano-Turanian region in terms of phytogeography and that Salt marshes and halophytic vegetation develops around the salt lakes and floristically very rich and includes many endemic taxa. Ipor *et al.,* (2002) investigated above ground biomass, relative frequency, relative density, relative dominance and important values of tree species of mixed dipterocarp forest of Mahua Crocker Range National Park Sabah, Malaysia. Shaltout *et al.,* (2002) analyzed the phytosociological behavior and size structure of *Nitraria retusa* (Forssk.) Asch shrub along the Egyptian Red Sea coast in relation to the prevailing environmental gradients. Based on TWINSPAN and DCA multivariate techniques *Typha domingensis,Zygophyllum coccineum –Zilla spinosa, Tamarix nilotica–Zilla spinosa, Nitraria retusa–Zygophyllum album* and *Nitraria retusa* groups were identified. The negative relationship between the density and size of this plant suggests that its size is density-dependent. Sharma & Upadhyaya (2002) studied foot hill, slope (middle hill) and top of the protected and unprotected hills of the Aravalli at Jaipur. Herbaceous vegetation was therophytic in nature, exhibiting maximum number of species during rainy season. The present study revealed an increase in the soil nutrients and species diversity at the protected hill and role of herbaceous vegetation in the conservation of nutrients at both hills.

Saxena *et al.*, (2004) worked on life form and leaf size spectra, leaf persistence, flowering season, and shade tolerance of trees in different vegetation types of north-western catchment of the river Gola in Kumaun Himalaya. The grassland vegetation was characterized by hemicryptophytes while the flora as a whole was therophytic. The biological spectrum for the entire Kumaun Himalays was of therohemigeophytic

type. The observation on leaf size indicated that microphyll dominated in all vegetation types. The vegetation expression was evergreen, with considerable deciduous elements. In all the flowering period most of the trees were vernal. Wergerand & Ellenbroek (2004) described leaf size classes and leaf consistency types of the woody species in the riverine forest. The data revealed a diversification of leaf sizes with changing climate from temperate to hot and arid and particularly microphylls became relatively less important and were replaced by smaller leaves in the hot areas. Batlaha & Martins (2005) stated that the Cerrado, the second largest vegetation type in Brazil showed a wide physiognomic range mostly similar to tropical savanna. The Raunkiaerian life form spectrum was mainly of hemicryptophytes and the phanerophytes. The former prevailing in the site with open physiognomies and the later in the closed physiognomies. Peinado & Aguirre (2005) described and typified the associations, alliances, orders, subclasses, and classes defining the chionophilous communities of the boreal, temperate and Mediterranean climates of western North America. Syntaxa were characterized by their floristic composition, physiognomy and biogeographical distribution, along with their position on the snow gradient.

Da Costa *et al.*, (2007) observed Raunkiaer 's system,and compared with his normal spectrum. Spectrum consisted of the life form that therophytes (42.9%), phanerophytes (26.3%), camaephytes (15.8%), hemi cryptophytes (12.8%), and cryptophytes (2.3%) in the semi arid region of northeastern Brazil. Dos Santos *et al.*, (2007) determined density, frequency, dominancy, importance value index of 61 arboreal species with diversity of H= 3.3. in Caatinga area in the north of Minas Gerais state. Jesson (2007) stated that ecological traits might influence species richness in Newzaland. Fleshy fruits have lower numbers of species than their sister lineages. He suggested that regional differences in community processes can influence speciation or extinction. Terzioolu *et al.*, (2007) described the flora and vegetation established 13 plant associations in Solakly watershed in Northeastern Turkey. The floristic compositions and abundance patterns of all plant associations were determined to evaluate the species diversity and richness of the study area. The α and β diversity were calculated by different categories of measures often used to quantify biodiversity within habitats. Cayuela *et al.*, (2008) evaluated the response of herbaceous communities to previous and current environmental conditions and stated

that water stress decrease alpha and beta diversity during community establishment. Fossati *et al.* (2008) recognized communities on the basis of two climatic gradients in Wadi vegetation in Saudia Arabia. The first is characterized by decreasing annual precipitations and an increasing mean annual temperature. The second presents an increase in the annual potential of evapotranspiration. A third gradient, a biogeographical exerts an important role in the floristic composition. Izco (2008) pointed out that phytosociological data have little use in taxonomy, but provide good materials of ecological, chronological and taxonomic information. The phytosociological behavior of taxa is a taxonomic feature. Kennenni (2008) while making geographical, phytosociological and environmental description of *Acacia tortilis,* revealed different plant community types due to variation in climatic, edaphic and biotic factors. Madsen & Ilgaard (2008) studied non-ridge forest and ridged forests had 75 species and 28 families ha^{-1} which ridge forest had 90 species and 38 families ha^{-1}. Salama & El-Naggar (2008) recognized *Capparis decidua* and *Tamarix nilotica* dominated end parts of the wadis in . The community reflects prevailing xerophytic conditions with well representation of *Zygophyllaeion coccini* are well represented in these wadis. Abdullahi *et al.,* (2009) quantitatively established plant communities in five habitats of Yankari Game Reserve, Bauchi, Nigeria. They modified the PCQ method and computed importance value index. A total of 40 plants species belonging to 33 genera and 7 families have been identified. Poaceae is the leading family. Brinkmann *et al.,* (2009) analyzed the vegetation response to environmental conditions of open woodlands along an altitudinal and a grazing gradient in the Jabal al Akhdar mountain range of Oman. Classification analysis and a Canonical Variate Analysis (CVA) indicated that species richness followed a unimodal distribution along the altitudinal gradient with the highest number of species at the intermediate altitudinal belt. Naqinezhad *et al.,* (2009) stated that there were parallel changes in vegetation both within wetlands and the surrounding steppes based on DCA/CCA analyses altitude appeared to be the primary determinant of floristic composition. Upper mountain wetlands are particularly species-rich and contain many endemics and other species of a narrow phytogeographical distribution. Hemicryptophytes are mainly restricted to upper mountain areas. Pignatti *et al.,* (2009) stated that vegetation class is the highest group in vegetation taxonomy and is defined mainly on the basis of character species. However, these are relatively rare and not always represent the ecological conditions of plant communities. They

stressed on more inclusive definition of the class, including spatial structure and environmental characteristics of the vegetation and the ecological distribution of character species

Oldeland *et al.*, (2010) presented a new approach that uses high spatial resolution hyperspectral datasets to map vegetation units of a semiarid rangeland in Central Namibia. They classified data by hierarchical cluster analysis into seven vegetation units that reflect different ecological states occurring in the study area.

Perspective in Pakistan

Qadir & Ahmad (1989) recognized *Pistacia–Cymbopogon-Chrysopogon* community and *Pistacia–Fraxinus-Cymbopogon* communities in Quetta. The vegetation was homogeneous and species diversity was moderate as community maturity was low. *Cymbopogon* and *Chrysopogon* were regenerating. Among trees *Pistacia khinjuk* had weak to fair degree of regeneration. Total plant coverage of the community was 32.42% out of which trees occupied 23.68% shrubs. Ahmad *et al.*, (1998) carried out phytosociological study rangelands of southern Attock. The invader plant species, which were widespread in unprotected areas, were being replaced with desirable forage tree and grass species in protected areas. Dastagir *et al.*, (1999) recognized seven plant communities at various altitudes of Mai Dhani Hill, Muzaffarabad. Index of diversity and its components equitability, species maturity decreased from low altitude to high altitude. The soil temperature decreases as the altitude increases. Ahmad & Khattak (2001) observed in Islamabad that the original natural and xerophytic vegetation has changed into mesophytic type due to large scale cultivation of trees. Berg *et al.*, (2000) recorded the phytosociological attributes of 2145 individuals in 141 species. Tareen & Qadir (2000) identified twenty-one plant communities, on the basis of index of similarity and grouped them into four different altitudinal zones. Vegetation compositions of different altitudnal zones were also described. Plant communities having first dominant common, were further grouped into four association types. Ahmad *et al.*, (2001) analyzed the vegetation, phytogeographical study in desert area of Bahawalpur. Seasonal differences were significantly variable, the highest in February and October and the lowest in May, positively related with precipitation of the area. Ephemeral/annuals are the new comers in this study area being the rarest and the poorest for Importance Value Index records. Malik *et al.*, (2001) analyzed the vegetation of Dao Khun, Azad Kashmir and recognized 10 communities with 83 species. The chemical contents of the soil played

a significant role in giving particular shape to these communities. Dastagir & Haq (2002) established *Themeda-Dodonaea-Maytenus, Dodonaea-Maytenus, Phoenix-Cynodon-Micromeria, Dodonaea-Otostegia-Themeda, Dodonaea-Themeda-Mallotus, Pinus-Hypodematium-Dodonaea* communities at Mai Dhani Hill, Muzaffarabad. With the increasing altitude the species diversity decreased. There was a decrease in soil temperature from lower to higher altitudes. Rana *et al.* (2002) described different life forms and biological spectrum of the Tons valley Garhwal , India. It included phanerophytes (29.06%), nanophanerophytes (6.47%), chameophytes (2.11%), geophytes (2.64%), hydrophytes and halophytes (8.58%), therophytes (17.83%), lianas (10.43) and epiphytes (0.66%). The Raunkaierian normal spectrum showed hydrochameophytic phytoclimate. Malik & Malik (2004) working on the life form of plants Kotli Hills, Muzaffar Abad, Azad Jammu and Kashmir, Pakistan, stated that nanophanerophytes and hemicryptophytes dominated the area. It was followed by magaphanerophytes and therophytes. Chamaephytes and geophytes were low in number. Whereas quantitatively, megaphanerophytes and hemicryptophytes were dominant. They were followed by nanophanerophytes and therophytes. Geophytes were low in number. The index of similarity in the communities was almost equal due to similar habitat, soil conditions and percentage of phosphorus and equal amount of potassium in soil. Qadir *et al.*, (2004) recognized six plant communities in Karachi University Campus on the basis of designating community dominants. The vegetation consisted of open communities, in which xerophytic and deciduous shrubs predominated. Rasheed *et al.* (2005) observed that *Olea ferruginea* was the dominant tree of Margalla Hills National Park Islamabad. It was first dominant in 7 out of 15 strands, followed by *Pinus roxburghii* as first dominant in 5 strands and *Mallotus philippensis* dominant in first 3 strands. The dominant shrub was *Myrsine africana* and the dominant grass was *Themeda anathera*. Enright *et al.*, (2005) recorded 466 plant species in 372 sample quadrats from desert vegetation of Kirthar National Park, Pakistan. Classification (Twinspan) and ordination (NMDS) of dry season vegetation data (using 368 species) identified nine 'natural 'and one 'cultural' vegetation assemblages. Major differences in species composition of vegetation existed between mountains, plains, wetlands and riparian vegetation. The vegetation of mountains, cliffs and canyons showed higher species richness and lower human impacts (from livestock grazing and wood harvesting) than did that of riparian and plains habitats. Hussain *et al.*, (2006) studied the vegetation of Machiara National Park and

recognized four dominant trees, 7 shrubs and 23 dominant herbs. Ahmad *et al.*, (2006) recognized 24 communities and 4 monospecific forest vegetations were recognized in Himalayan forests of Pakistan. Many communities show similar floristic composition, however, differ in quantitative values.

Adam *et al.*, (2007) carried out a vegetation study on the slope of Lok Kawi Hill.

Malik *et al.* (2007) and Nafeesa *et al.*(2007) concluded that the vegetation of Pir Chinasi hills can be used as a typical example of natural vegetation due to protection. On the whole 13 plant communities were recognized with a total of 77 species. It was found that chemical contents of soil played a significant role in giving particular shape to these communities. Qureshi (2008 a) described five plant communities, 1) *Phragmites-Typha-Saccharum* in wetland; 2) *Calligonum-Dipterygium-Salvadora* in desert; 3) *Saccharum-Pluchea-Typha* in marshland; 4) *Desmostachya-Brachiaria-Cynodon* in agriculture habitat and 5) *Salvadora-Desmostachya-Posopis* in protected forest in Sawan Wari of Nara Desert. The most densely populated species was *Typha elephantina* followed by *Salvadora oleoides, Saccharum bengalense, Phragmites karka, Saccharum spontaneum, Prosopis juliflora* and *Dipterygium glaucum.* The most frequent species *Euphorbia prostrata* was present in all habitats, followed *Alhagi maurorum, Desmostachya, Saccharum spontaneum* which were found in 4 habitats. Qureshi & Bhatti (2008) identified 145 species of five habitats from Nara Desert, Thar. The flat habitat had the highest species richness while the crest habitat has less number of species. Mostly the vegetation is characterized by xerophytic adaptation whereas saline and wetland habitats possess halophytes and hydrophytes. The species composition showed differences in species richness. Ahmad *et al.*, (2008) examined vegetation of Kufri Soon Valley, Pakistan site on the basis of topography, soil type and the nature of whole growth prevailing disturbances. They reported that *Acacia modesta* was the most common species. *Propsopis juliflora* formed mono-species stands. *Olea ferruginea* formed association with *Acacia modesta* at higher altitudes. *Dodonaea viscosa* and *Justicia adhatoda,* due to its resistance for grazing and occurred abundantly. Cutting of woody plants, grazing and accidental fires are the major threats to the vegetation in this valley.

Parveen *et al.* (2008) reported 79 plants species including three rare species from Dureji game reserve, Vegetation cover varied with texture and structure of the soil. Grazing is one of the main threats to the vegetation. Hussain & Perveen (2009) worked on the plant biodiversity and phytosociological attributes of the Tiko Baran,

Khirthar range,District Dadu. Ali *et al.*, (2009) conducted a trail to measure the dry matter intake by sheep fed basal and basal + corn stover treated with different nitrogen sources. They concluded that ammonia treatment of corn stover was more effective in enhancing the dry matter intake by sheep than those fed urea or poultry litter-treated diets. Addition of cattle waste in urea treated stover tended to improve the palatability of corn stover over urea treatment alone, but the difference was non significant. Similarly, the treatment of corn stover with poultry litter did not improve dry matter intake or palatability compared to untreated control. Qureshi *et al.*, (2009) analyzed vegetation and soils of roadsides of Abbottabad. The floristic data were analyzed by using multivariate analysis techniques *i.e.* Detrended Correspondence Analysis (DCA) and Canonical Correspondence Analysis (CCA). A total of 63 plant species and 5 major communities were recognized along 5 major roadsides as demarcated by DCA and CCA. The study also investigated the vegetation structure and its relationships to selected environmental factors. The most important factors influencing the roadside vegetation were found to be lead and copper, and zinc to some extent. Siddiqui *et al.*, (2009) phytosociologically studied *Pinus roxburghii* in Lesser Himalayan and Hindu Kush range of Pakistan from 750 - 1700 meters elevation. *P. roxburghii* formed pure vegetation in 12 stands. Pine seedlings were recorded in nine stands. The common angiospermic species found in association with Chir pine were *Dodonaea viscosa, Punica granatum, Erodium cicutarium, Medicago denticulata* and *Vicia sativa.* The most rare species encountered were *Ailanthus altissima, Daphne mucronata, Melia azedirach, Potentilla nepalensis, Urtica dioica* and *Olea ferruginea.* It was also observed that the studied forests were unstable and degraded and would be vanished if not maintained properly.

Perspective in Khyber Pukhtoon Khwa

Chughtai *et al.*, (1989) stated that the vegetation od Miranjani Galyath, District Abbottabad has considerably changed over twelve years period, especially on east west and south facing aspect. Whereas least changes were noticed on north facing slopes. The vegetation was dominated by *Koeleria gracilis, Sibbaldia cunneata, Potentilla gerardiana, Nepeta erecta* and *Duchesnia indica.* Despite the changes in herbaceous and shrubby vegetation, no tree species was noticed advancing up the top. Grazing, avalanches and fast blowing winds appear not to allow conifers and other broad leaved species to get established there. Hussain *et al.*, (1989) stated that vegetation of waterlogged and saline areas of Peshawar Valley were similar in

composition due to similarities in habitat and environmental conditions and that it represented seral stages of succession. Hussain *et al.*, (1993) described three main vegetation types from 20 graveyards of District Swabi on the basis of similarity indices, importance values and floristic composition. *A. modesta* was widely distributed in the area. The variation in the dominant species was due to edaphic and biotic disturbance. They suggested that the existing vegetation might further change due to under ground seepage of water from nearby Turbela dam. Later on Hussain *et al.*, (1994) observed that soil pH; $CaCO_3$ and P_2O_3 were found to be the controlling factors in the distribution of the vegetation. Hussain *et al.*, (1997) stated that the original chir pine (*Pinus roxburghii*) forests of have been replaced with open scrub or grassland through deforestation, terrace cultivation and overgrazing.

Hussain & Badshah (1998) after investigating the vegetation of Pirghar Hills, South Waziristan Agency, Pakistan stated that the air and soil temperatures were higher on south facing slope, which decreased with increase in altitude. The vegetation, life form and leaf size of south and north slopes differed at similar altitudes. Leptophyllous species increased with the rise in altitude. The original woody species was present on the hills as isolated individuals due to degradation. Malik & Hussain (2006) used agglomerative clustering, WINSPAN and DCA for the plant community analysis. Characteristic plants with dominance and sub-dominance species were presented. Four plant communities were identified. Peer *et al.* (2007) studied the grazed vegetation of the eastern Hindu Kush Mountains, used two-way indicator species analysis for hierarchical classification of community data, and canonical correspondence analysis (CCA) for examining relationships between the vegetation and selected environmental parameters. They identified relation to locality, altitude, soil conditions and grazing pressure, eleven plant communities, linked to four vegetation types in the study area. The communities differ floristically and phytogeographically, with plants showing characteristic patterns of adaptive trait variation. The most important ecological factors influencing the above vegetation types and plant communities are altitude, geographical position (longitude more than latitude), grazing intensity and organic matter content. Sher & Khan (2007) showed that the biological spectrum consisted of that therophytes (86 spp., 38.56%) and nanophanerophytes (41 spp., 18.38%) followed by megaphanerophytes (38 spp., 17.04%), geophytes (18 spp., 8.07%), hemicryptophytes (17 spp., 7.62%), chamaephytes (14 spp., 6.27%) and lianas (9 spp., 4.03%). Leaf spectra consisted of

microphylls (54.70%), mesophylls (19.28%), nanophylls (13.00%), leptophylls (8.96%) and megaphylls (4.03%). Perveen & Hussain (2007) conducted study on plant biodiversity and phytosociological attributes of the Gorakh hill Kirthar Range. Some Ecological parameters such as, life forms, species density, species cover, species relative density and frequency phenological status were analyzed. Hussain *et al.*, (2009) stated that plant density, frequency and cover varied among grasses, trees and shrubs across the three growth seasons. There was highly significant difference in grasses, trees and shrubs in all four range sites.

Chemical evaluation of Forage Plants

Ahmad *et al.* (2009a) investigated the forage Pb, Ni and Cr concentrations with respect to the nutrient requirement of the grazing ruminants in the Soone Valley, Salt Range, Pakistan. It was concluded that the concentration of these minerals varied among different pastures and even in different plant parts. The concentrations of Pb, Ni and Cr observed in the forage from Salt Range are significantly higher than their critical levels already known in the literature. Thus, this forage may cause toxicosis problems in animals grazing the area.

Ahmad *et al.* (2008) analyzed dominant forage plants for Cu, Mn, Fe and Zn in the leaves and pods. The plants have varying minerals composition and showed clear differences for the Zn and Mn in leaves but not in pods. It was known that the forage species studied are palatable and have much higher concentration of those elements required for the live stocks.

Ahmad *et al.* (2009b) analyzed the nutritive value of leaves of fodder trees *Grewia oppsitifolia, Morus alba, Betula celtis, Celtus australis, Diospyros lotus, Aesculus indica, Celtis caucasica, Robinia pseudoacacia, Olea ferruginea, Melia azedarach, Ailanthus chinensis* and *Quercus incana* were selected from Chagharzai valley in Bunair district, Pakistan. for dry matter (DM), organic matter (OM), ash, crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), hemi-cellulose and lignin contents.

Hameed *et al.* (2008) analyzed the proximate composition including proteins, crude fibers, fats and oils, moistures, ash contents and carbohydrates and like C, O, Na, Mg, Al, Si, S, P, Cl, K, Ca, Ti, Fe and Br in *Rumex hastatus, Rumex dentatus, Rumex nepalensis, Rheum australe, Persicaria maculosa and Polygonum plebejum* of the family Polygonaceae. Hussain & Durrani (2008) found non significant differences in minerals between grasses and shrubs from Harboi rangeland, Kalat. Cu

concentration was higher in shrubs than grasses while Mn was higher in grasses than shrubs. K and Fe were sufficient while P and Zn were deficient in most of the forage plants. Cu concentration was present at toxic level for livestock. It was concluded that poor livestock productivity is due to insufficient amount of mineral efficient forage. Mn^{2+} and Se^{2+}, and forage Cu^{2+}, Fe^{2+}, Zn^{2+}, Mn^{2+} and Se^{2+}.

Khan *et al.* (2006) studied the levels of macro and micro minerals of herbage forages of a grazing pasture of District Leiah. The grazed forages had different concentrations of Ca and Mg, and were slightly higher than the recommended levels. The forages had lower levels of Cu and low to moderate level of Zn. The forages had high levels of Fe.

Khan *et al.* (2004a) determined trace elements of the forage plants and soils on a goat ranch in the semi arid region of Punjab. High forage value of Cu and Mn were found in winter while Fe and Zn found in summer. Mn was adequate while Fe, Cu, Zn were below the critical value in all sites. All soil elements were high in site three. Soil Cu was found below the critical value in site two in both seasoned during summer in site 1.

Khan *et al.* (2004b) determined forage mineral concentrations with regard to nutrient requirement of grazing sheep. The concentration of Ca, Mg, K and Na were not affected by the sites but Mg of site two was found high in summer. Ca and Mg concentration were adequate in all sampled soils but that of Na and K were low. All regions have adequate forage level of Ca, Mg, K but Na was deficient in both soil and forage. Khan *et al.* (2005) investigated the micro mineral status of pasture thickly populated by small ruminants in Punjab. Soil Se^{2+}, Cu^{2+}, Zn^{2+}, were affected by sampling period while all forage minerals except Se^{2+} were affected the sampling time.

Hussain & Durrani (2009) analyzed the mineral composition including K, P, Cu, Mn, Fe and Zn of some grasses and shrubs from Harboi rangeland, Kalat, Balochistan at three phenological stages. There were no-significant differences between grasses and shrubs in K, P, Fe and Zn contents. The concentration of Cu was higher in shrubs than grasses while Mn was higher in grasses than shrubs. The differences in the K, P, Mn, Fe and Zn were insignificant among the various phenological stages. Generally K and Fe were sufficient while P and Zn were deficient in most of the analyzed forage plants. The concentration of Cu was mostly within the toxic range for livestock. The mineral concentration of forage plants

generally increased/ decreased inconsistently with the advancing phenological growth stages in most plants. Across all the grazing seasons the forage for sheep and goats was generally deficient in one or other mineral at some stage for growth and maintenance. They concluded that the poor livestock productivity in Harboi rangeland is partially due to insufficient amount of mineral efficient forage.

Shabir *et al.* (2009) reported the seasonal effect on Ca, Mg, Na and K status in both plants and goats in Punjab, Pakistan. The mean concentration of these metals was high forage in summer while low in winter. Plasma contained higher concentration of Mg both in lactating and dry classes during winter than those during summer. Both seasons affected by plasma Na concentration with higher concentration in summer than that in winter among all the groups of goats under investigation.

Sultan *et al.* (2009) reported the isolation and characterization of essential oil of Rosa centifolia. It had 0.225% concrete oil and 0.128% yield of absolute oil.

Abbasi *et al.* (2009) compared legumes and grasses and find out that white clover provides forage with high nutritional value and quality. Mineral nutrient contents in white clover were substantially higher than those found in the grass. Among macronutrients, the content of P and K were 0.32 and 1.96%, while the contents of N, Ca and Mg were 2.61, 1.10 and 0.29%, 2–3 fold to the content found in the grass. Micronutrients also showed similar trend and the concentration of Fe, Mn, Cu and Zn were 192, 86, 31 and 49 mg kg-1, almost double than those in the grass. The ratio between Ca/P, Ca/Mg, Ca/K, K/Mg, K/P was 3.9, 4.0, 0.6, 6.8 and 6.2, respectively showing positive balance of mineral nutrient elements in white clover. Growing over two years in the field, white clover increased substantially the concentration of C, N, P and K in soil indicating its potential for improving the nutrient status of the soil.

Khan *et al.* (2009) showed seasonal effect on Ca, Mg, Na and K status in both plants and goats at a particular Livestock Experimental Station in the Punjab province of Pakistan. The concentration of these metals was high in summer while low in winter. Plasma contained higher concentration of Mg both in lactating and dry classes during winter than those during summer; however, a reverse trend was noted for most groups during both the seasons. Plasma K concentration was non-homogenous in all the classes with higher concentration in males followed by dry goats. Both seasons affected plasma Na concentration with higher concentration in summer than that in winter among all the groups of goats under investigation.

Bano *et al.* (2009) determined seasonal concentration dynamics of nitrogen, phosphorus, magnesium and calcium in *Chrysopogon aucheri* and *Cymbopogon jwarancusa* at a protected site. The concentration of nitrogen in spring ranged from 12.4 to 13 mg g-1, early summer 15.4-17.26 mg g-1 and late summer aaa6.7 to 10.7 mg g-1, respectively during 2001 and 2002 seasons. In 2001, the concentration of P in spring and early summer was (1.1-3.4 mg g-1) and least in late summer (0.26-0.81 mg g-1) while in 2002 the concentration of P in spring and early summer was significantly higher (1.28-3.35 mg g-1) and least in late summer (0.38-1.01 mg g-1). In both grasses the N: P ratio was below < 14 suggesting N-limitation during March and July and showed more than >16 during drier months of August and September. Overall, both the grasses are low in N, P and other nutrients except Na and Ca. These findings suggest that heavy but short-term grazing of very long protected grasslands after substantial rainfall may be one strategy to increase palatability and animal nutrition.

Ahmad *et al.* (2009c) evaluated growth biomass dead accumulated biomass of *Chrysopogon aucheri* (Boiss) Stapf., and *Cymbopogon jwarancusa* (Jones) Schult. were evaluated during 2001 and 2002 in a protected site of Hazarganji-Chiltan National Park in highland Balochistan. *Cymbopogon jwarancusa* current season biomass ranged from 27 kg/ha in April to 51 kg/ha in June whereas *Chrysopogon aucheri* current season biomass production ranged from 2 kg/ha in April to 54 kg/ha in June. Above ground dead biomass of *Cymbopogon jwarancusa* ranged from 77 to 310 kg/ha whereas the dead biomass of *Chrysopogon aucheri* ranged from 50 to 320 kg/ha. In both years the dead biomass remained more than 70% in the growing season. The protected site had a higher accumulation of aboveground dead material and limited new growth. Accumulated dead materials reducing the productivity of these grasses and planned grazing or clipping may improve the productivity and quality of these grasses.

Nisar *et al.* (2009) determined moisture, ash, fiber, protein, fats, oils and carbohydrates in the whole plants samples of *Indigofera gerardiana* and berries of *Crataegus songrica*. The levels of moisture (4.8), ash (4.79) and fats (3.03) were higher in *Crateagus songrica* compared to the levels of moisture (3.06), ash (4.23) and fats (2.37) in *Indigofera gerardiana*. The levels of protein (3.7) and fibers (17.8) were same in both plants while the level of carbohydrate (68.84) was higher in

Indigofera gerardiana as compared to the levels of carbohydrate (65.88) in *Crataegus songrica.*

Khan *et al.* (2009) studied the effects of sampling frequencies on mineral status of *Trifollium* pastures in central Punjab, Sargodha at the livestock station Khizarabad in relation to cattle requirement. Forages were analysed for copper, iron, manganese, and znic, and cobalt. Forage Co and Cu concentrations were low and deficient in relation to cattle requirements grazing therein for most of the sampling periods. In relation to cattle requirement, the majority of forages were deficient in Co, Cu and Zn. Based on the results of this study it can be concluded that the mineral supplementation on this ranch is strongly encouraged.

Khan *et al.* (2009) analyzed some macrominerals (Na, K, Ca and Mg) and microminerals (Mn, Fe, Zn and Cu) forages for grazing ruminants at the Government Livestock Experimental Station in Central Punjab, Pakistan. They showed that pasture grasses/ forages had sufficient levels of K, Ca, Mg, Mn, Fe and Zn to meet the requirements of ruminants being reared there but the occurrence of marginal to deficient supplies of Na and Cu appears very likely in this area of investigation. Food supplements containing Na and Cu are recommended for maximizing the potential of livestock production in this particular ranch of animals.

Sultan *et al.*(2009) analyzed *Denothera vosea, Athyrium acrotiochoides, Chenopodium album, Polygonum amplexicaule, Atrimisia maritima, Oriosma lispidum, Cynoglossum lanceolatum, Plantago ovata, Hackalia macrophyla, Lespedeza spp., Urtica dioca* for dry matter (DM), organic matter (OM), ash, crude protein (CP), neutral detergent fiber (NDF), acid detergent fiber (ADF), hemi-cellulose, and lignin contents. The average values for DM, OM, ash, CP, NDF, ADF, hemi-cellulose and lignin were 27.5±1.66, 24.2±1.33, 11.6±0.96, 12.3±1.42, 56.7±1.87, 30.9±1.24, 25.8±1.42 and 4.4±0.42, respectively. The average values for Ca, P, K and Mg at were 0.62±0.066, 0.033±0.003, 0.85±0.118, and 0.012±0.002, respectively and average values for Cu, Zn, Mn and Co were 24.59±5.439, 22.64±3.314, 12.18±1.757 and 0.049±0.008, respectively. In species, the highest ($p<0.05$) potential intake rate (PIR) was observed for *Denothera vosea* (59.00±11.70 g/4 minute) and lowest for *Urtica dioka* (36.30±11.03 g/4 minute). However, the highest ($p<0.05$) relative preference (RP) was noted for *Denothera vosea* (81.55±1.61%) and lowest for *Urtica dioka* (10.28±4.38%). The average *in vitro* dry matter digestibility (IVDMD) and metabolizable energy (ME) of fodder herbs species

were 52.4±3.02% and 1.67±3.021 MJ/kg DM, respectively. The IVDMD, RP and PIR values are indicative that fodder herbs be fed to livestock with some supplementation for different levels of production and types of livestock.

Milosevic *et al.* (2009) determined N, P, K, Ca and Mg contents during the growing season in 2005-2007. Highest seasonal changes were observed in the contents of Mg (CV=18.19%) and N (CV=12.95%) and the lowest ones in P content (CV=4.00%). Highest leaf contents of N (1.83±0.07%), P (0.43±0.09%) and K (1.77±0.04%) during the season were produced by cv. Nochione and those of Ca aaa(1.27±0.07%) and Mg (0.44±0.42%) by cvs. Tonda Gentile Romana and Istarski Duguljasti, respectively.

Malik *et al.*(2010) assessed total contents of 6 toxic metals viz., Pb, Cu, Zn, Co, Ni, and Cr in the soil and plant samples of 16 plant species collected from industrial zone of Islamabad. The concentration, transfer and accumulation of metals from soil to roots and shoots was evaluated in terms of Biological Concentration Factor (BCF), Translocation Factor (TF) and Bioaccumulation Coefficient (BAC). Total metal concentrations of Pb, Zn, Cu, Co, Ni, and Cr in soils varied between 2.0-29.0, 61.9-172.6, 8.9 to 357.4, 7.3-24.7, 41.4-59.3, and 40.2-927.2 mg/kg. Total metal concentrations pattern in roots were: Cu>Cr>Zn>Ni>Pb>Co. Grasses showed relatively higher total Zn concentration.

Review on Conservation status of Plants

Shinwari *et al.* (2002) described the conservation status of medicinal plants in Pakistan Hindu-kush Himalayas. They estimated that more than 10% of the flora is threatened, and 12% of the flora of Pakistan is used medicinally. They mentioned that the total number of medicinal plants of District Swat ranged from 55 to 345 species.

Linkie *et al.* (2004) observed that it must need fine scale information to use their budget for law enforcement and identified the forest area which is most susceptible to deforestation. According to them low elevation and surrounding of roads are more prone to deforestation as compared to others. In the future this methodology could be used in conservation planning for the protection of the vulnerable areas.

Toledo & Basin (2005) discussed three issues of secondary succession in tropical forests i.e. under storey and over storey changes, continuous as opposed to phase changes and integration of forest succession with indigenous fallow

management and plant uses. They sampled 28 fallows, stratified by four success ional stages and ten stands of mature forests. 20 ×50m plot was used for over storey and 2×5m for under storey. Canopy height, basal area liana density of over storey increase with secondary forest age. Early stage has low specie density and diversity in over storey.

Lagenberge *et al.* (2006) aimed to analyze forest remnants and to evaluate their role as refuge to the largely destroyed low land forest vegetation. A total of 49 plots were studied. Records represent 8% of the known Philippine vascular plant species. 52% of the species are endemics. 41 (6% of all taxa) tree species are included in the IUCN red list, either as vulnerable, endangered or critically endangered. Phanerophytes dominate life form followed by lianas and chamaephytes. The most common families were the Rubiaceae and Euphorbiaceae. The area provides an important gene bank and high value for biodiversity conservation.

Hernandez-Stefanoni & Dupuy (2007) estimated the number of species in a tropical forest landscape in Quintana Roo, Mexico, based on the relationship between reflectance values of satellite imagery and field measurements of plant species density. Total species density as well as that of tree, shrub and vine species were identified from 141 sampling quadrats.

Heenan *et al.* (2008) reported new records of Naturalized and Casual plants for the flora of New Zealand during 2004 to 2006. Six species were fully naturalized and 162 plants were considered to be new records of casual plants. They proposed a new scheme of classification for the modes of establishment of weeds in the casual category that further subdivides this into cultivation escape, spontaneous occurrence, garden discard, and intentional release.

Naughton-Treves *et al.* (2008) viewed that parks are effective at protecting deforestation. Initiatives were taken to link protected areas to local socioeconomic development. Some of them are successful, but in general, expectations need to alleviate poverty. Attention must be paid to the broader policy biodiversity loss, poverty, and unsustainable land use in developing countries.

Winter *et al.* (2008) evaluated a common approach to forest biodiversity. The results show positive possibilities for achieving a moderate level of European-wide harmonization.

De Lange *et al.* (2009) used the 2008 version of the threat classification system for conservation status of the indigenous New Zealand vascular plants. The

list comprises 6 extinct, 180 threatened, 651 at risk, 25 plants listed as either Vagrant (12) or colonizer (13), and 35 as Data Deficient. Overall, the conservation status of the New Zealand indigenous vascular plant flora is worsening, with 7.6% of this flora now regarded as threatened with extinction.

Mark *et al.* (2009) updated the conservation (protected area) status of New Zealand's indigenous grasslands from 2000 to 2007. A substantial increase in the indigenous protected grassland was found due to at its high altitude and government's continued review of high country leasehold tenures but low to mid-altitude systems continue to be poorly protected and are undergoing rapid land transformation.

Ali & Qaiser (2009) collected all of these plants from the wild, 7 of which are reported as scarce locally. Unsustainable collection methods, poor post harvest methods, soil erosion and intense deforestation are the main causes of the depletion of local flora. As the Chitrali people still partly depend on medicinal plants for majority of their ailments, therefore loss of these plant resources will, to a certain extent, hamper the existing healthcare system in the area. Measures for the conservation of plant resources especially medicinal plants of Chitral valley are urgently needed.

Sher *et al.* (2010) conducted research to evaluate the growth performance of six medicinal species (*Aconitum laeve, Bunium persicum, Saussorea lappa, Podophyllum hexandrum, Delphynum roylei* and *Hypericum perforatum*) from upper Swat, Pakistan. Experiments were conducted at four different locations in the upper Swat valley at altitudes ranging from 1200 to 1900 m a. s. l.

3. Materials and Methods

Location

Chakesar Valley District Shangla is located on the bank of River Indus. It lies from 34^0-$31^{/}$ to 33^0-$08^{/}$ North latitudes and 72^0-$33^{/}$ to 73^0-$01^{/}$ east longitudes. The altitude varies from 1150m to 3400m from mean sea level (Fig. 1).

3.1. Survey of the Valley and Site Selection

The area was surveyed in four consecutive years (2007 – 2010) in three seasons.

Field trips were initiated from July, 2007 and were continued up to January, 2010. Five sites Viz. Oona, Dhali, Gumrush and Totash, Bahkt Banda and Khadang Mountains were selected on the basis of floristic, physiographic, physiognomic and edaphic variation (Fig. 1). The data was collected in three seasons i.e., spring, summer and winter. A care was taken to collect the data from the same area for each season.

Each site was further divided into different stands on the basis of physiognomy, altitude and vegetation. The stands were approximately spaced at a distance of 100 meters from base to the top of mountain.

3.2. Floristic Composition

To prepare a complete floristic list, plants were collected during spring (April), summer (July & August) and winter (November & December) seasons from 2007 to 2010 in different parts of the valley. Plants were dried, tagged with localities, habitat informations and plant characteristics. They were preserved, and mounted on the standard herbarium sheets. Plants were identified with the help of Flora of Pakistan (Nasir & Ali, 1971-94; Ali & Qaiser, 1995-2010). The identification of the plants was further confirmed at the Herbarium, Department of Botany, University of Peshawar and National Herbarium NARC, Islamabad.

. The plants with voucher numbers were submitted to the Herbarium, Department of Botany University of Peshawar, Pakistan. A complete alphabetical floristic list of species along with families and ecological characteristics are given.

3.3. Raunkaierian Life form spectrum

Plants were classified into various life form classes after Raunkiaer (1934) and Hussain (1989) into the following classes.

A. Phanerophytes

The perennial buds are carried well up in the air and exposed to varying climatic conditions. They are shrubs and trees. Phanerophytes are further divided into following classes on the basis of height.

1. Megaphanerophytes: (Mg). 30+ m (100ft+)
2. Mesophanerophytes: (Ms). 7.5-30 m (25-100ft)
3. Microphanerophytes: (Mc). 2-7.5m (6-25ft)
4. Nannophanerophytes: (N). 0.25-2m (0.8-6ft).

B. Chaemophytes

Perenating shoots or buds are located above the surface of the ground upto 25cm above the surface. They are also called surface plants. Typical of cool and dry climates.

C. Hemicryptophytes

Perennial buds lie at the surface of the ground where they are covered by soil and litter or with rosette leaves. Such plants are found in cold and moist climates.

D. Geophytes (Cryptophytes)

Perennial buds are buried in the ground in the form of bulb or rhizome or underground reproductive parts where they are protected from freezing and drying. Hydrophytes are included in this category.

E. Therophytes

Annual plants that complete their life cycle from seed to seed in one year. Plants survive as seeds in unfavorable condition. Such plants are typical example of grassland and deserts.

F. Climber and Lianas

These plants are rooted in the soil but they grow on other plants for support. Their roots may hang in the air or cling to the supporting plants. They depend on other plants for support only. They may herbaceous or woody climbers.

G. Parasites

That depends on other plants for food, for their survival. They are parasitic plants. They may shoot or root parasites.

Raunkiaer Biological spectrum of the flora was calculated using the following formula.

$$\text{Raunkiaer Biological Spectrum} = \frac{Number\ of\ species\ of\ a\ particular\ life\ form\ class}{Total\ number\ of\ all\ species\ in\ a\ stand} \times 100$$

3.4. Leaf size spectrum

Plants were classified into the following leaf size classes, after Raunkiaer (1934)

A. Leptophyll (L), 25sq. mm.
B. Nanophyll (N), 9×25sq. mm.
C. Microphyll (M), 9^2×25 sq.mm.
D. Mesophyll (Me), 9^3×25 sq.mm.
E. Macrophyll (Ma), 9^4×25sq.mm.
F. Megaphyll (Mg), larger than class E.

Raunkiaer (1934) Leaf size spectrum was determined as followings

$$\text{Raukiarian Leaf Size Spectrum} = \frac{Number\ of\ species\ of\ a\ particular\ leaf\ size\ class}{Total\ number\ od\ all\ species\ for\ that\ stand} \times 100$$

For rapid determination of leaf sizes of plants in the field, Raunkiaer (1934) diagram was used.

3.5. Phenological study

Phenological events were observed for during all the three seasons for three consecutive years. Plants were classified into following three phenological stages.

1. Pre – reproductive stage (Vegetative stage)
2. Reproductive stage (Flowering stage)
3. Post reproductive stage (Dormant) dispersal in annual.

3.6.1 Ethnobotanical Profile

Plants were classified into ethnobotanically importance on the basis of their local uses in the valley. The local elders, nomads and villagers with indigenous knowledge were interviewed. For this, 400 questionnaires were filled by asking various questions (Annexures. 01, 02, 03, 04). Based on this information plants were classified into different categories of utilization such as medicinal, economic, forage, fuel, and myth and timber wood etc. The following procedures were adapted to document the knowledge.

Besides interviews with elderly knowledgeable person, 400 different performa were distributed among 400 respondents (Annexure 1, 2, 3, 4) 100 of each in 16

villages. The respondents include local Hakims, nomads and knowledgeable and experience elders.

3.6.2 Corroboration

The ethnobotanical knowledge obtained was documented, checked and compared with the available literature and was thoroughly analyzed.

3.6.3 Market Survey

A chain of marketing men and women are present in the valley that collect the plants, store and sell to the vendors who visit village periodically. Informations were also collected from vendors and then discussed with the local people.

3.7.1. Phytosociology and Vegetation structure

A rectangular quadrat measuring 1.0×0.5 m was used for analyzing herbs, 10×5m quadrat was used for shrubs and 15×10m quadrat was used for trees. Data was collected at every 100m altitudes. 10 quadrats were laid down each for herbs, shrubs and trees.

The following community attributes were measured.

3.7.2. Density

It is the average number of individuals of a species per quadrat which is obtained by dividing the total number of individuals of that species in all the quadrats by the total number of quadrats (Hussain, 1989).

$$\text{Density (D)} = \frac{\text{Number of Individuals of a species}}{\text{Area sampled (Total Number of quadrats)}}$$

$$\text{Relative Density (RD)} = \frac{\text{Deensity of a particular species}}{\text{Total density for all the species}} \times 100$$

3.7.3. Frequency

It is the percentage of quadrats in which a species is recorded (Hussain, 1989).

$$\text{Frequency (F)} = \frac{\text{Number of quadrats in which a species occurs}}{\text{Total number of quadrats sampled}} \times 100$$

$$\text{Relative Frequency (RF)} = \frac{\text{Frequncy value of a particular species}}{\text{Total frequency valus for all the species in a stand}} \times 100$$

3.7.4. Canopy Coverage

It is defined as the vertical projection of crown or shoots area of species to the ground surface expressed as a fraction or percent of a surface area (Hussain, 1989).

For determination of canopy coverage, Daubenmire's cover scale was employed (Daubenmire, 1959) as follows:

Class	Range of Coverage	Mid Points %
1	Covering up to 5% of the Ground	2.5.00
2	Covering 5% to 25% of the Ground	15.00
3	Covering 25% to 50%of the Ground	37.00
4	Covering 50 % to 75%of the Ground	62.00
5	Covering 75% to 95%of the Ground	85.00
6	Covering 95% to 100%of the Ground	97.50

The coverage classes were converted into mid points. Total coverage was calculated by adding all the mid points for a species in the area.

$$\textbf{Canopy Coverage (C.C)} = \frac{\text{Sum of the mid points of the spcies}}{\text{Total area sampled}}$$

$$\textbf{R.C.C.} = \frac{\text{Canopy cover of a particular species}}{\text{Total covrage for all the species in stand}} \times 100$$

3.7.5. Basal area

It refers to the ground actually covered by a crown of a tree only. It is a cross section area of a tree measured as diameter at breast height (DBH), i.e., 1.5 m above the ground. In order to obtain the cover, the diameter of the crown is taken by the help of measuring tape. Basal area can be calculated by the following formula.

$$\text{Basal Area} = \pi r^2 \quad \left(\text{Where } r = \frac{\text{Circumfere nce}}{2\pi}\right)$$

$$\text{Basal Area (BA)} = \frac{\text{Area of species calculated from circumference at DBH}}{\text{Total area sampled}}$$

$$\text{Relative Basal Area (RBA)} = \frac{\text{Basal area of a particular species}}{\text{Total basal area for all the species with in a stand}} \times 100$$

Basal area was also computed from basal area table (Cox, 1967 ; Hussain, 1989).

Importance Value

Importance value of a species was calculated by adding RD, RF and RCC (Hussain, 1989) as follows.

Importance Value (I.V) = Relative Density + Relative Frequency + Relative Canopy Coverage/Basal coverage

3.7.7. Naming of the Communities

On the basis of the highest importance values of the first three dominant species species, the communities were established and named. Wherever stands were dominated by single species then it was named after single species.

3.8. Species Richness

It is expressed as simple ratio between number of species and the square root of the total number of all individuals. Species richness was calculated after Menhinick (1964) using the following formula.

$$d = \frac{S}{\sqrt{n}}$$

d= Species richness

S= Total number of species in a stand

N= total number of individuals in a stand

3.9. Species Diversity

Species diversity was determined after Shannon-Wiener (1961) index as follows.

$$H' = -\sum_{i=1}^{s} pi \log epi$$

Where:

H' = the value of the Shannon- Wiener diversity index

pi = the proportion of ith species

$\log_e$ = the natural logarithm of p_i

s = the number of species in the community

To calculate H', determine the proportions of each species in the community, pi, and $\log_e$ of each p_i Next, multiply each p_i time's $\log_e$ p_i and sum the results for all

species from species 1 to species s, where s is the number of species in the community. Since the sum is negative, this index calls for taking its opposite, that is

$$-\sum_{i=1}^{s}$$

The minimum value of H′ is zero, which is the value of H′ for a community with a single species, and increases as species richness and species evenness increase.

3.10. Maturity index

It indicates the maturity of a community which was measured after Pichi-Sermollis (1948).

Degree of maturity index = $\frac{Ft}{N}$

Where

Ft = Frequency values of all species in a stand

N = Total number of species in a stand

3.11. Community Similarity

It is used to compare different stands of a site. It is the number of species common to both communities and is % of the total number of communities. It was calculated using Sorensen index (1948) as follows.

$$Is = \frac{2C}{A+B} \times 100$$

Where

Is = index of similarity of Sorensen.

C = Number of species common to both communities.

A = Total number of species of community A.

B = Total number of species of community B.

3.11. Equitability

It explains the ratio between observed diversity and to the maximum diversity possible for the same number of species. It was determined after Pielou's method (1975) as follows.

$$E = \frac{\ln e}{\ln t}$$

Where

lne= Natural logrithum of expected value of Shannon-Wiener index

lnt = Natural logrithum of total species in a community.

3.12. Regeneration capacity

It indicates age and population status of a community. It was determined by classifying woody plants into different diameters classes. The class interval was 25cm.

Classes	Diameter Range
1	01 – 25
2	26 – 50
3	51 – 75
4	76 – 100
5	101 – 125
6	126 – 150
7	151 – 175
8	176 - 200

3.13. Degree of Homogeneity

It was determined by classifying plants into various frequency classes by using Raunkaier's (1934) Law of frequency.

Frequency class	Range
1	1 – 20
2	21 -40
3	41 -60
4	61 – 80
a. 5	81 - 100

The normal distribution of frequency % derived from such classification is expressed as

$$A > B > C \leq \geq D < E$$

3.14. Constancy Classes

Constancy values were calculated similar to frequency but for different stands with same five classes.

3.15. Multivariate Analysis

The data was classified using two way indicator species analysis (TWINSPAN; Hill, 1979 a) to evaluate site impact on species assemblage. The vegetation types identified were named after the first and occasionally the second dominant species and the data matrices of species abundance (percent cover) versus sites were subjected to Detrended Correspondence Analysis (DCA; Hill, 1979b) based on gradient length and preliminary correspondence analysis (Jongman *et al.*, 1995). The concept underlying this technique is that of association between samples. As the association measure increases, so does sample similarity. DCA was used to find a linear combination of explanatory variables which could have explained a large part of variation in species data. A non parametric Spearman Rank correlation coefficient was used which assumes that the relationship is simple. (Hill & Gauch, 1980). DCA ordination offered two significant ordination axes (gradient) for communities and species. All analysis was performed using the software PCORD ver. 4.16 (McCune & Mefford, 1999).

3.16. Edaphology

Soil samples were collected at a depth upto 30cm from three different places in each stand and mixed to get a composite sample. Physiochemical analysis including texture of soil, organic matter, pH, EC, nitrogen contents, potassium and phosphorus was determined following standard methods (Jackson,1962 & Hussain, 1989).

3.17. Degree of Palatability

Palatability is the property of being acceptable to eating. It was recorded directly at the spot. Information about palatability of plants from local villagers and gujors (herders) and nomads were also collected. The plants of the area were classified into the following palatability classes.

A. Non palatable

These plants are not grazed by animals.

B. Palatable

These plants are grazed by the animals and were further classified as follows

a. Rarely palatable

b. Less Palatable

These plants are less preferred by the animals.

c. Highly Palatable

The plants which are mostly preferred over other plants by animals throughout the season.

C. The palatable species were further classified into 3 types on the basis of parts grazed by animals as follows.

a. Whole plant grazed

b. Leaves/Twigs grazed

c. Flowers/Fruits grazed

D. The palatable species were also classified into two groups as follow, whether grazed in:

a. Fresh form

b. Dry form.

E. Animal preference

Animals select different plants according to their choice of selection. The palatable plants were classified according to animal preferences such as grazed by goats/sheep, cattle or both.

3.18. Forage Biomass

It is the standing amount of above ground plant materials present in a unit area at any given time. It is regarded as an important indicator of ecological and management processes in the rangeland vegetation. Plants that dominate a site in terms of biomass are reflection of the plants that are controlling the nutrient, water, and solar resources on the site. Therefore, biomass is often measured to assess the ecological status and productivity of a site. It was determined separately for herbaceous and shrubby vegetation as follows.

3.18.1. Herbaceous Biomass

It was determined by harvest method, using 1×0.5 m^2 quadrat. Five quadrats were selected in each community part of harvested above ground. Plants were weighed in the field to get fresh weight. The data was obtained in grams/unit area and then changed to per hectare.

3.18.2. Shrub Biomass

It was calculated using reference technique after Kirnse & Noston (1985). A part of the plant (10 -20% of the weight of average plant) was selected as reference unit and weighed fresh. The number of branches were counted and multiplied by average weight to get estimate of the shrub biomass.

3.19. Chemical Evaluation

13 species listed in table from different altitudes at three phenological stages of Chakesar Valley were selected for chemical evaluation. The selection of these plants was based with respect to human and animal use. The concentration of copper , zinc, iron, manganese, nickel, cadmium, lead, chromium, calcium, magnesium, sodium, potassium and phosphorus were determined using the following procedure.

3.19.1. Wet Digestion

One gram dried crude powdered plant sample was taken in a beaker and 10 ml concentrated HNO_3 (Nitric Acid) was added. It was allowed to stand overnight. After 24 hours 4ml perchloric acid was added to each sample and kept for 25 minutes. The sample was heated till it evaporated to a small volume. The samples were cooled and then transferred to a 50ml volumetric flask and diluted with100ml solution and filtered. The stock solutions were marked with names and coded numbers and were analyzed through atomic absorption spectrometer for quantitative detection of the following elements.

3.19.2. Preparation of stock/ standard solutions (100ppm)

10 ml of 1000 ppm standard stock solutions of each element was taken in 100 ml volumetric flask and was made to the volume with double distilled water.

3.19.3. Standard solutions (2.5, 5, 10 ppm)

Working standard solutions (2.5, 5, 10 ppm) were prepared by taking 2.5, 5, and 10 ppm of 100 ppm stock solution in a series of 100ml volumetric flask and volume was made up to the mark with double distilled water.

Table 3.1. Instrumental conditions for determination of concentration of different elements in the plant samples.

Instrumental Conditions											
S.No		Cu	Zn	Fe	Mn	Ni	Cd	Pb	Cr	K	Na
1	Flame type	Air/Acet.	Air/Acet.	Air/Acet.	Air/Acet.	Air/Acet	Air/Acet	Air/Acet.	Air/Acet.	Air/Acet	Air/Acet
2	Wavelength (nm)	324.8	213.9	248.3	279.5	232	279.5	232	357.9	766.5	589
3	Silt width (nm)	0.7H	0.7H	0.2H	0.2H	0.2H	0.2H	0.2H	0.7H	0.7H	0.2H
4	Acetyleneflow (L/min)	2	2	2.3	2	2	2	2	2.5	2	2
5	Air oxide flow (L/min)	17	17	17	17	17	17	17	17	17	17
6	Cathode lamp current	15	15	30	20	20	20	20	25	12	0.8

3.19.4. Instrumental condition for different elements in the samples

Procedure

The instrument was set according to the instrumental conditions required for respective elements (Table. 3.1). The respective cathode lamp was turned on and allowed to warm up for 10 minutes and the air acetylene flame was ignited. The instrument was calibrated and standardized with working standard of 2.5, 5, and 10ppm of the standard stock solution 0f respective minerals (Parkin Elmer). Working standards were run as unknown to verify the standardization. The sample stock solution was aspired into the flame and concentration of respective element was calculated in ppm.

3.20. Proximate Composition

Moisture, ash, crude fats and crude protein contents were determined by standard method of AOAC (2000). Nitrogen free extract was calculated by difference. Energy value in calories was computed by multiplying the protein and carbohydrate percentages by 4.1 and that of crude fat by 9.1 (Khalil & Saeemullah, 2004).

3.20.1 Moisture content Determination

Moisture content was determined by oven dried bass by heating following Hussain (1989).

3.20.2. Crude Fat Determination

Crude fat was determined by ether extract method using Soxhtec (labconco) apparatus. One g moisture free sub sample was wrapped in filter paper, placed in thimble and then introduced in the extraction tube. Pre weighed, clean and dry receiving beaker was filled 1/ 3rd with petroleum ether and fitted into the apparatus. Extraction was done up to complete drying of solvent.

The percent of crude fat was determined as follow.

$$\% \text{ Crude Fat} = \frac{(Wt\ of\ beaker + Ether\ extract) - (Wt\ of\ beaker) \times 100}{Wt\ of\ Sample}$$

3.20.3. Ash Determination

A clean crucible was heated in a muffle furnace at 660^{0}C for an hour, then cooled it in desiccators and weighed it as (W_1). 1 g sample was placed in the crucible (W_2). The sample was charred over the burner with the help a blowpipe. The crucible was then placed in a muffle furnace at 550^{0}C for 6 -8 hours. After the complete ignition the

furnace was turnoff. The crucible was cooled and weighed (W_3). Percent ash was calculated as follow.

$$\% \text{ Ash} = \frac{Wt\ of\ Ash\ (W3-W1)\times 100}{Wt\ of\ sample}$$

3.20.4. Determination of Crude fiber

Crude fiber was determined by acid and alkali digestion method (Khalil & Saleemullah, 2004). The weighed samples were first digested with acid and then with alkali. One gm sample was taken in a clear beaker and 100 ml of 2.5 % HCl was added to it. The mixture was boiled with stirring for about half an hour. It was drained into the beaker. The fiber residue was again digested in 2.5 % NaOH in a similar manner like that of acid digestion. The residue so collected was transferred to a dried crucible to remove the moisture. Then the weight of the dry crucible was noted. The crucible was then kept in furnace for red dull heat till the formation of white and grey ash. The crucible was cooled in desiccator and weighed again. The loss in weight of the dry residue upon ignition was taken as the amount of crude fiber. Percent crude fiber was calculated as follow.

$$\% \text{ Crude Fiber} = \frac{(W1-W2\times 100)\times F}{Wt\ of\ Sample}$$

Where

F = Value of crude fat

W1 = Weight of dry crucible

W2 = Weight of crucible after heating

3.20.5. Determination of Crude Protein

One g sample was taken in a digestion flask and 8 g of digestion mixture K_2SO_4: $CuSO_4$ (8:1) and 12 ml of conc. H_2SO_4 was added. Some piece of pumice stone was also added to avoid bumping of solution. The flask was swirled in order to mix the contents thoroughly. It was then placed on heater under fume hood to start digestion and continued till the mixture becomes clear. After digestion, the heater was turned off and flask was cooled. The digest was then transferred to 100ml flask and volume was made up to the mark by the addition of distilled water. Distillation of the digest was performed in markam still distillation apparatus. 10 ml of digest was taken with the help of pipette and was introduced in the distillation tube through funnel. Then 10 ml of NaOH was

gradually added through the same way. Distillation was continued for at least 10 minutes and NH_3 produced was collected as NH_4OH in a conical flask containing 20ml of 4% boric acid solution with few drops of modified methyl red indicator. The tip of condenser was washed in the flask with distilled water. During distillation pink color changed to yellowish due to NH_4OH. The distillate was then titrated against standard 0.05HCl till the appearance of pink color. A blank was also run following the steps as mentioned above. % crude protein was calculated as follow.

$$\% \text{ Crude Protein} = 6.25 \times \%N$$

$$\% N = \frac{(S-B)\times N\times 0.014\times D\times 100}{Wt.of\ sample\times V}$$

Where

S = Sample titration reading

B = Blank titration reading

N = Normility of HCl

D = Dilution of the sample after digestion

V = Volume taken for distillation

0.014 = Miliequivilent Wt of Nitrogen

3.20.6. Nitrogen Free Extract

Nitrogen free extract represents the digestible carbohydrate and can be found by the difference. This value was obtained by subtracting the sum of the percentage of moisture, crude fiber, crude protein, crude fat and ash from 100 (Iqtidar and Saleemullah, 2004).

NFE = 100 – (% Moisture + crude fat + crude protein + fiber + ash)

3.20.7. Energy Calculation

The caloric value of the sample was calculated from the energy yielding components i.e. fats, protein and carbohydrates. The crude fat was multiplied by 9.1 and the sum of protein and carbohydrates was multiplied by 4.3.

The sum of resulting figures (fat, protein and carbohydrates) will be kilo calories (kcal0 per 100 gm sample.

3.20.8. Carbohydrate Determination

Carbohydrate was computed by subtracting the weights of protein, fats, crude fibers, ash, and moisture contents from 100.

3.21. Environmental Data

Environmental data was collected for each site using Watch dog weather station, 2010. The environmental parameters like humidity; temperature, altitude, leaf wetness, Par light, Rain fall etc. were calculated.

3.22. Conservation status of some plants

Plants were classified using IUCN Red Book data (2001) categories to determine the conservation status as follows

The four categories proposed in IUCN Red Book data (2001) are as follows.

1.Availability

0=Uncommon or very rare
1=Less common or rare
2=Occasional
3=Abundant

2.Growth

0=Regrowth in more than 3 years
1=Regrowth within 3 years
2=Regrowth within 2 years
3=Regrowth within 1 year
4=Regrowth in a season

3.Collection

0=More than 1000kg/yr
1=Consumed from 500-1000kg/yr
2=Consumed from 300-500kg/yr
3=Consumed from 100-200kg/yr

4.Part used

0=Root/Whole plant
1=Bark
2=Seeds, Fruits
3=Flowers
4=Leaves/Gum/Latex

Total Score

0-4 Endangered
5-8 Vulnerable
9-12 Rare
13-14 Infrequent
15-16 Dominant

a. Availability is the accessibility of plants in an area. It is recorded whether the species is rare, less common, occasional or abundant.
b. Collection is the accumulated part of the species that how much part of the plant is collected per year in kg.
c. Growth is the emergence of plant and it was observed that how much time a species takes to regenerate if it is stock up.
d. Part used i.e. which part of the plant is used by the local people of a species whether they use its root, bark, seeds, flowers or leaves.

The local people especially nomads/ Gujors have valuable information about plants occurrence, distribution and habitats. Important informations were confirmed on the spot, visiting various localities. Personal observations were also made in field keeping several parameters such as availability, collection, growth and part used (Annexure 05). 100 questionnaires were distributed, giving numbers to each category, summed up and species were categorized into the endangered, vulnerable, rare, infrequent and dominant classes (Annexure 05).

4.1. Floristic Composition and its Ecological Characteristics

A considerable importance in ecological work has been given to floristic composition and its characteristics as it is necessary to know species that make the vegetation. The floristic composition is simply a list of the species and its ecological features.

The present study identified a total of 319 plant species (Table 4.1) including one valuable mushroom *Morchella esculenta*. These belonged to 85 families and 215 genera. There are 75 families of dicotyledons having 178 genera and 276 species. Monocotyledons had 5 families, 26 genera and 30 species. Gymnosperms had only one family Pinaceae (1.6%) with 3 genera and 5 species (Table. 4.1). It includes *Abies pindrow* Royle, *Picea smithiana* (Wall.) Boiss. *Pinus gerardiana* Wall. ex Lamb. *Pinus roxburghii* Sargent. and *Pinus wallichiana* A. B. Jackson. The pteridophytes had 8 genera and 8 species within 4 families. *Morchella esculenta* Pers. Ex Fr. Was the only mushroom (Table 4.1). As a whole Poaceae (26 species), Asteraceae (25 species), Lamiaceae (23 species), Papilonaceae & Rosaceae (each with 21 species), Moraceae (10 species), and Polygnaceae and Solanaceae (each with 9 species) were the leading families in terms of number of species (Fig. 4.1).

Among dicotyledons, Asteraceae was the leading family with 25 species (7.8%), followed by Lamiaceae (23 sp; 7.7%), Papillionaceae & Rosaceae (each with 21 sp; 6.6%), Moraceae (10 sp; 3.1%), Polygonaceae & Solanaceae (each with 9 species 2.8% each). Brassicaceae, Cucurbitaceae and Ranunculaceae each had 8 species (2.5%). Apiaceae, Carryophyllaceae, Euphorbiaceae and Malvaceae had 6 species each (1.9% each). Seven families had 4 species (1.3%), 8 families had 3 species each (0.9%) another 8 families had 2 species each (0.6%). Each of the remaining 34 families contributed single species to the flora (Fig. 4.1). Among monocotyledons, Poaceae with 26 species (8.2%) dominated, which was followed by Asparagaceae, Alliaceae and Asphodelaceae.

The floristic richness is shown by the presence of 319 plant species, of diverse taxonomic and ecological nature. Batalaha & Mantovani (2001) recorded 360 vascular species belonged to 236 genera and 69 families. They reported Asteraceae and Fabaceae as the most common families. This is similar to the present list. In our case the numbers of families were 85. Similarly, Abuodha *et al.*(2003) identified 174 plant species belonging to 62 families in which Papilionaceae and Poaceae were

dominant families. This also supports the present findings. Klein *et al.* (2007) recorded that Asteraceae and Poaceae as the richest families. Jafri & Akhani (2008) reported 607 plants belonged to 329 genera and 85 families with dominance of Poaceae. Hussain & Perveen (2009) reported 70 plants from Dureji game reserve while Sher & Khan (2007) stated that flora of Chagharzai valley consisted of 222 plant species study. These worker also reported that Poaceae and Asteraceae had the maximum species and this agree with the presen. All these studies agree with the present work as same families as represented by us are having highest number of species in their studies.

It is observed that diversity in floristic compositions is related to altitude, precipitation and other local ecological features of the area. Berg *et al.* (2000) suggested that rainfall and altitude strongly influence the floristic differences among different forests. However, Steege *et al.* (2000) stated that rainfall is not a good reason for tree diversity.

The two research sites viz. Dhali and Oona, are close to each other with at least same level of precipitation but they had different vegetation. Similarly, two other sites namely: Dhanakol and Bakht Banda varied in vegetation due to variation in altitude and precipitation. Adam & Mamat (2005) and Cattanio *et al.* (2002) stated that slight topographic change affects forests composition along topographic gradients. It is obvious in all the studied sites that different topography supported different floristics with variety of communities. In our case it appeared that topography and aspects delineated the floristic composition and vegetation. Oona Hills had different vegetation and flora due to difficult terrain and inaccessibility, which protected it from overgrazing and human influences.

Similarly, tree invasion had impact on floristic composition. This invasion has substantially facilitated or antagonized the impacts on population of many plant species (Butler *et al.*, 2005). *Ailanthus altissima* is an invasive exotic species which was recorded in all the five investigated hills. It reached to the top of Oona Hill, Dhali Hill and Dhanakol Hills. It is spreading at alarming rate and has replaced the natural vegetation in many parts of this area.

The investigated area is under severe grazing pressure except Bakht Banda where topgraphic conditions did not allow sustaining existence through out the year. Transhumants stay for short time in summer and then move their herds to the Kohistan district. Sasaki *et al.* (2005) stressed that the pattern of floristic composition

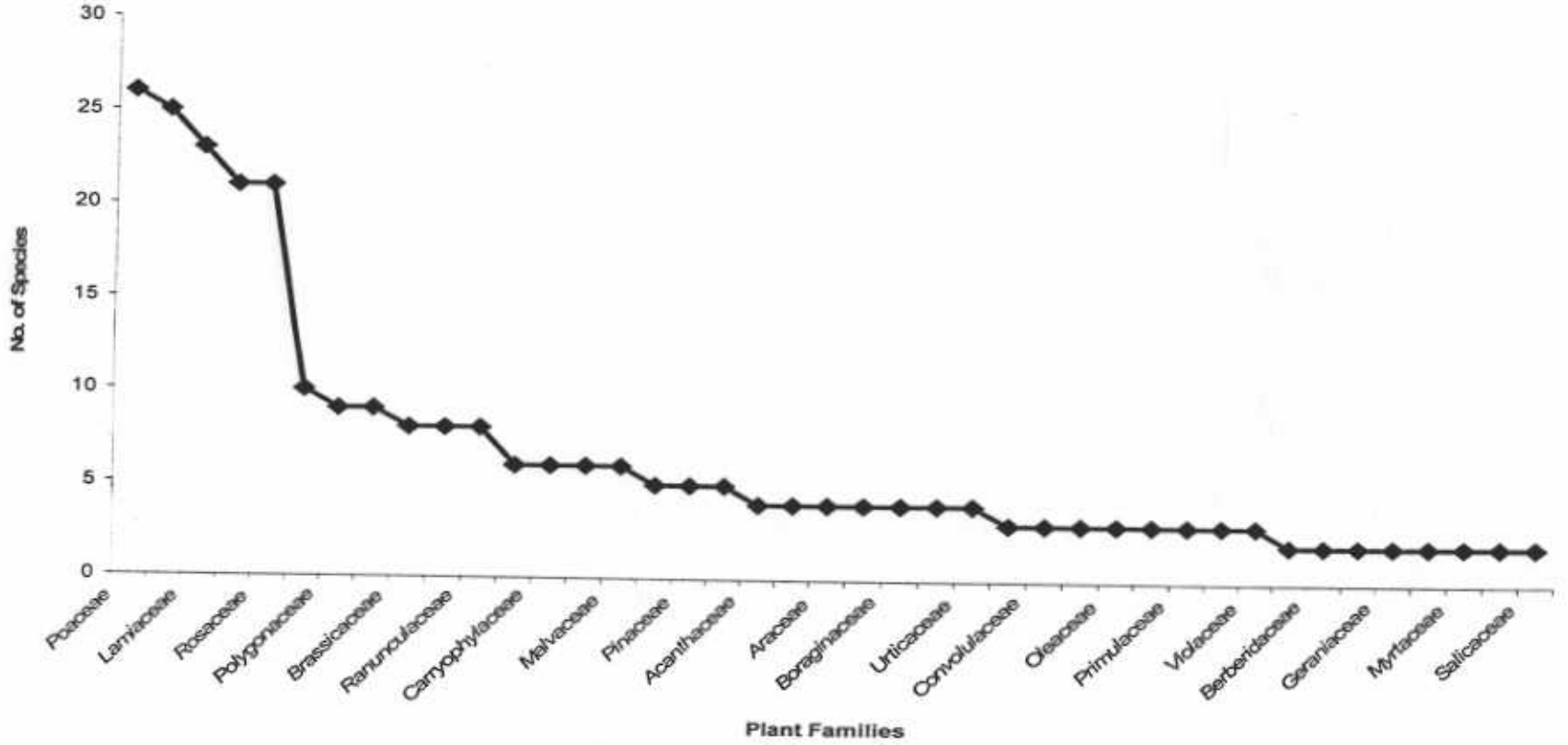
is governed under different grazing intensities. After analyzing the soil moisture and landform features they concluded the pattern of floristic composition is not affected but high grazing intensities were responsible for change in floristic diversity. However, Visser & Both (2005) stated that phenological behavior of many species mistimed due to climatic changes. Haugaasen & Per (2007) were of the opinion that unflooded forests were most diverse floristically. Dhanakol Hills where land slide occurred and supported poor diversity due to rain water.

Fire is another factor that limits plant composition. Although, it is not a promising one in the area. Fire does not have any significant impact; however, Morrison *et al.* (2006) stated that fire frequency account for about 60 % floristic variation but this is not the case.

Soil moisture and water availability are important factors which governs seed germination and survival of plants and thus plant diversity. Drought had dramatically not only decreased the accessibility of plants but had also badly affect availability of nutritious flora and reduced the honey yield in the area. Cayuela *et al.* (2008) had same inspiration that water stress decreased alpha and beta diversity during community establishment.

Madsen & Ilgaard (2008) investigated that floristic composition changed significantly irrespective of time. Phenological behavior of many species mistimed due to climatic change. Putin *et al.* (2010) discussed species responses to climate change that strongly rely on projecting altered environmental conditions on species distribution. Climate change also influences species interaction. They also discussed that how these interactions may alter during climate change and result species range shifts. It is suggested that conceptual analogies between species responses to climate warming and exotic species introduced in new ranges. These results are also similar to our works. Durrani & Razaq (2010) discussed that protected rangelands had rich floristic diversity than unprotected one. The investigated site had some rangelands that were unprotected and highly disturbed. Qureshi & Bhatti (2010) strenghthened our view that floristic composition is affected by anthropogenic activities with coupled with irrigation water deficit and allelopathic behavior of alien species. Ibrar *et al.* (2007) also stated that people living in Ranyal Hills are very poor and they lack basic health and livelihood facility like electricity, gas and coal. Our research area also lacks these facilities and this is the main cause of interference in local vegetation.

Fig. 4.1. Plant families sharing Floristic Composition of Chakesar Valley, Shangla, Pakistan.



4.2. Raunkaierian Life form spectrum

Life form spectrum is useful in comparison of areas, which are widely separated geographically having no common species. Life form is directly evolved in response to the climatic conditions. The proportions of life forms in an area give a better understanding of its climatic zone. The biological spectrum of the flora of Chakesar Valley revealed that it is mainly shaped as therophytic vegetation as there were 173 species (54.23%) therophytic species. The cryptophytes constituted 11.6%, chamaephytes 10.34%, microphanerophytes 10.03% and nanophanerophytes 6.3%. Mesophanerophytes, hemicryptophytes and megaphanerophytes contributed 3.5%, 2.5% and 1.6%, respectively. The area is mostly characterized by subtropical vegetation in the lower reaches while Kandao site (altitude 1900 meters to 2500 meter asl.) had dominanace of mesophanerophytes (Table 4.1; Fig. 4.2).

The research area consisting of five different hills supported heterogenous habitats and could be classified as Irano-Turanian phytochory. The semi arid in the lower reaches and humid climate in the upper parts had diverse vegetation of herbaceous, shrubby and trees strata. The results showed that Chakesar valley is rich in phytodiversity with therophanerophytic phytoclimate. The phanerophytes were and chamaephytes were similar to the normal spectrum but hemicryptophytes were less than and cryptophytes were more than normal spectrum. Guo *et al.* (2009) reported that phanerophytes were dominant in their area of investigation. Manhas *et al.* (2009) concluded that therophytes were dominating life form in swamps, representing high anthrapogenic disturbance in the region and limited niche space for vegetation. Therophytes are adapted to the dryness of the region and shortage of rainfall because these plants spend vegetative period in the form of seed (Asri, 2003). Hemicryptophytes adapted to habitat conditions by using different ways such as reserving water, using ground water, reducing their water need by losing their leaves and reduction of vegetative growth. In fact life forms of the plants indicate the possibility of adaptation of plants to environmental condition especially climatic condition. Moradi *et al.* (2010) also reported the dominance of hemicryptophytes in their regions which belonged to Irano Turanian region. They stated that therphytes more than normal and phanerophytes less than normal that is indicating the area is arid climate. Rana *et al.* (2002) stated the vegetation had biological diversity showed

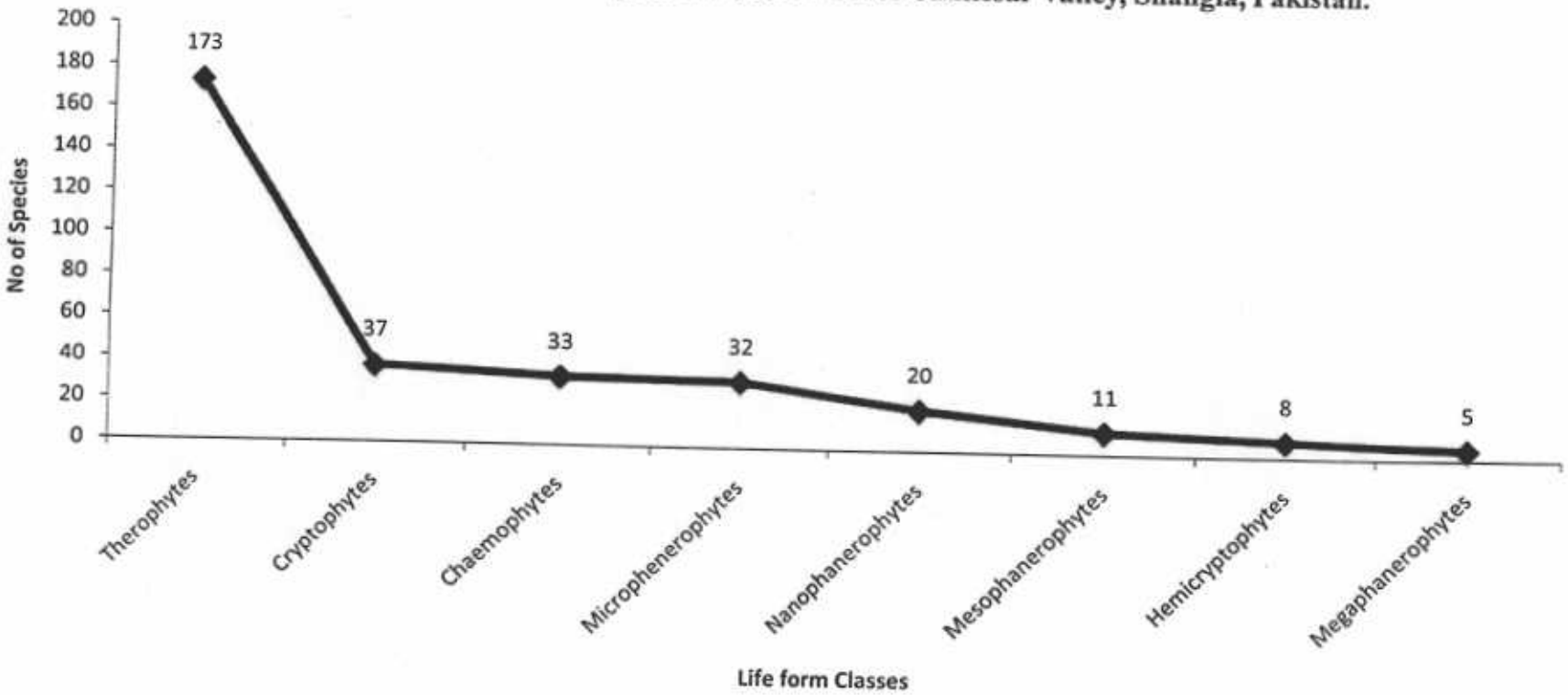
hydrochamaeophytic phytoclimate. Grassland vegetation is characterized by high % age of hemicryptophytes while the whole flora is therophytic and vegetation is thero hemigeophytic. In such cases the flowering period is vernal (Saxena *et al.*, 2004). According to Nadaf & Mortazvi (2011) hemicryptophytes were the dominant life form class and most plants belong to Irano Turanian floral elements in their area of investigation.

The predominance of therophytes reflects an effective strategy for avoiding water losses due to humidity extremes and water deficiency. The importance of therophytes increases with decreases of rainfall. Difference in amount of phanerophytes and therophytes in this region with Raunkiaer normal spectrum is too much and this may be a result of dryness of the region (Moradi *et al.*, 2010).

The Kando Hill (Bakht Banda site) presented a wide physiognomic variation than other sites. It had a closed and tallest physiognomy and considerably varies in climatic conditions. It was dominated by phanerophytic vegetation with microphyllous leaf form class. Dhanakol prevailing decidous phanerophytic vegetation with leaf form microphylous. Gumrush Hill has nanophanerophytes with microphyllous leaf form. Dhali and Oona Hill had open physiognomy and supported scrubland vegetation. Hemicryptophytes and chamaephytes prevailed in these habitats. The proportion of phanerophytes expected to increase from openphysiognomy to close one. Bakht Banda is the best represented site for closed physiognomy where phanerophytes increased with altitude.

Furthermore, with regards to other survey of Batalha & Mantovani (2001) observation of species was done in the field for one year whereas our study was completed in three years i.e. from 2007-2010. Hence our results considered all possible life forms classes over period of three years. Similarly, Durrani *et al.* (2005) while working on floristic of Harboi range land, Kalat (Pakistan) based on their conclusion on three years studies.

Fig. 4.2 Raunkiarian Life form spectrum of the flora of Chakesar Valley, Shangla, Pakistan.

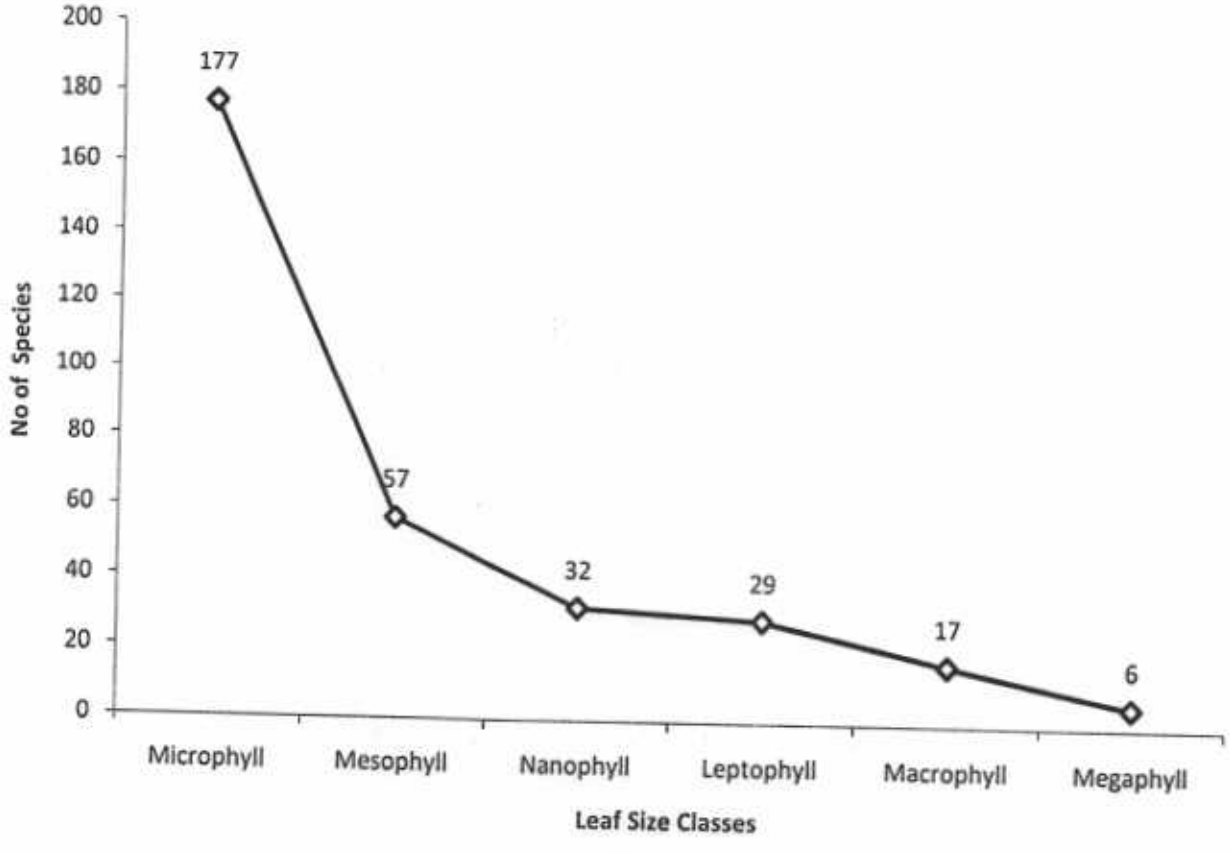


4.3. Leaf Size spectrum

The Fig. 4.3 depicts that leaf size spectrum is predominantly characterized by microphyllous (177 sp; 55.7%) species followed by mesophyllous species (57 sp; 17.9%). There were 32 (10.1%) nanophylls and 29 species (9.1 %) leptophyll. The macrophyll (17 sp.) constituted 5.3% and 6 sp., (1.9 %) to the leaf spectrum (Table 4.1).

The vegetation is mostly evergreen but with considerable deciduous elements. Dhanakol and Gumrush prevailing decidous phanerophytic vegetation with leaf form microphyllous. Gumrush hill has nanophanerophytes with microphyllous leaf form. Wergerand & Ellenbroek (2004) discussed that leaf size classes and leaf constancy type of the woody species revealed a diversification of leaf sizes as the climate changed from temperate to hot and arid and particularly microphylls became relatively less important and were replaced by smaller leaves in the hot area. Sher & Khan (2007) also described leaf spectra of plants consisted of microphylls followed by mesophyll and nanophyll. Their results agree with us. Gou *et al.* (2009) investigated that microphy was dominant and leaf quality was mainly papery and conaceous. This is similar to us. Al-Yemni & Sher (2010) described that microphyll dominated the study area followed by nanophyll, leptophyll and mesophyll. The leaf size spectra indicated that micro Nanophyllous species were dominating the area and Sher & Khan (2007) also showed that microphylls was dominant followed by mesophylls nanophylls leptophylls and megaphylls.

Fig. 4.3. Leaf form spectrum of Flora of Chakesar Valley, Shangla, Pakistan.



4.4. Classification Based on Habit

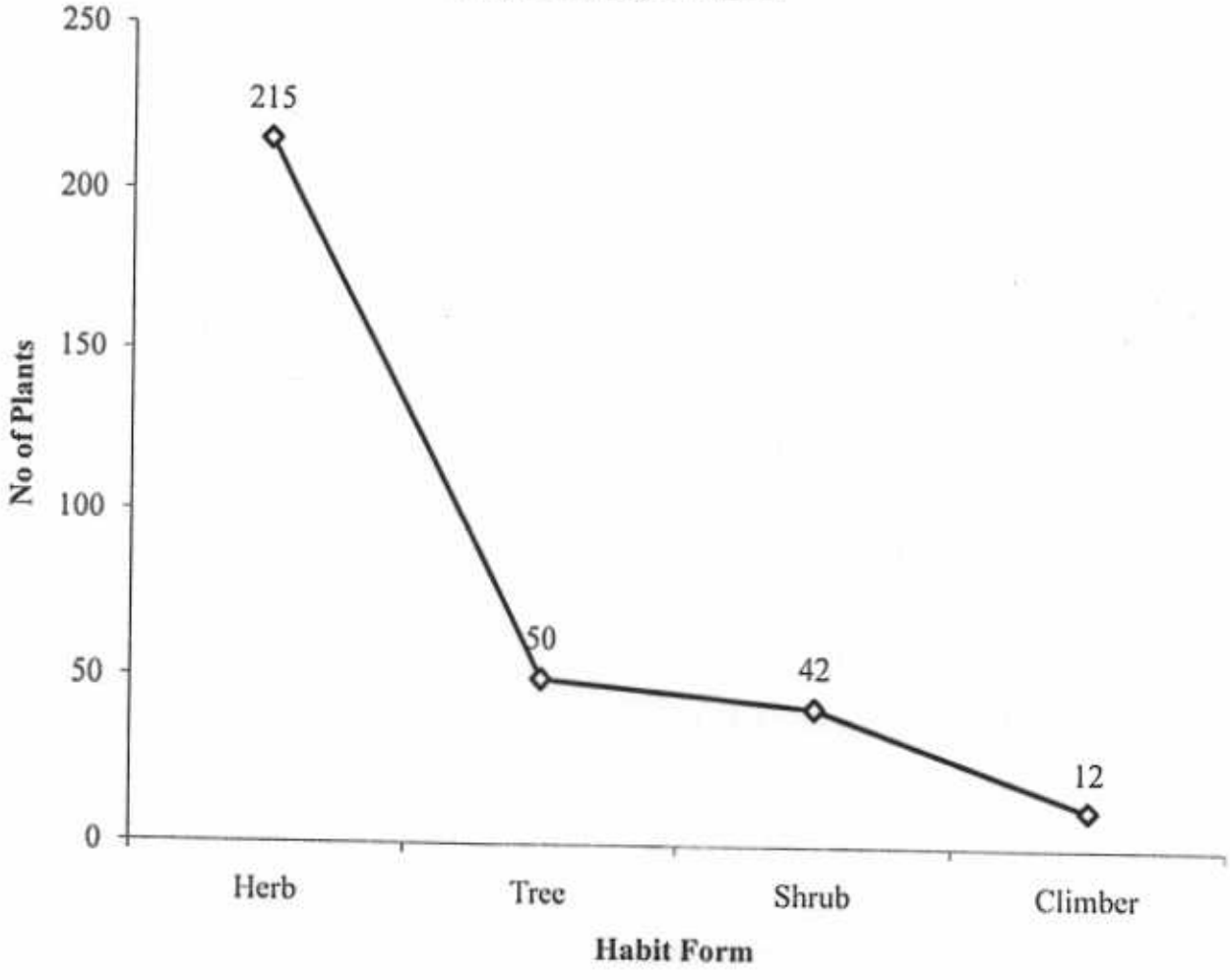
Considering only the habit, it was clear that there were 215 (67.4%) herbs followed by tree 50 (15.7%) species and 42 shrub (13.2%) and 12 species (3.8%) were climbers (Fig. 4.4).

The previous discussion confirmed that 67.4% plant species were herbs and dominated by therophytes. Tree species contributed 15.7% and vegetation was thero phanerophytic. The contribution of each group of habit form indicated that shrubby layer is under intense pressure of biotic factors. The shrubby layer is insignificant in Dhanakol hill. Vegetation is two layered (an herb layer at ground level and canopy of tree layer) here. It is obvious that these hills had developed tropical forests except Kandao Hills.

Fig. 4.4 showed that dominant habit form was of herbs, followed by trees, shrubs and climbers. The lowest number of habit form recorded for climbers, it indicated climatic and biotic disturbance. The highest % was noted for herbs, showed micro-thero phanerophytic climate.

The habit form is an important characteristic in understanding the vegetation structure and stratification of an area. Based on life form and habit form there could be following stratification of flora. The tree layer makes the first strata. It is composed of *Pinus roxburghii, Pinus wallichiana, Abies pindrow*), median size tree layer consisting *Picea smithiana, Acer oblongum, Alnus nitida*, small size (*Acacia modesta, Morus alba, Morus nigra, Juglan regia*). There are two shrub layers. The tall shrub layer is composed of *Rubus fruiticosus, Rosa, Rosa indica, Rosa macrophylla, Robinia pseudocacia* and the 2nd shrubs layer is characterized by *Berberis lycieum, Indigofera hetrantha, Plectranthus rogusus.* The herbaceous layer is rich with many annual and perennial herbs. The last layer is cryptogamic layer decorating by variety of cryptogams.

Fig. 4.4. Classification of the flora based on habit of Chakesar Valley, Shangla, Pakistan.



4.5. Phenological Behavior

The investigated area has four distinct seasons in a year with obvious variation in the floristic biodiversity. There are two major flowering seasons commencing from

March in lower parts like Dhali, Oona, Dhanakol and Gumrush that extends to May in the upper parts like Kandao. During the first flowering season 98 species (30.7%) bloomed, including 67.3% herbs, 7.1% shrubs and 25.55 % trees. The second blooming occurs from June to the August that had 81.2% species in bloom. They included 72.4% herbs, 14.6% shrubs and 11.2% trees. During fall, in autumn only 40 species (12.5%) flowering including 8.55 % are herbs, 7.5% are shrubs and the remaining 7.5% are trees. During the dormant winter only 1.25 % species areas were in flowering stage. Most of the investigated area was covered with snow starting from the foot hills of upper parts to the top hill of the area like Kandao, Dhanakol and upper parts of the Gumrush (Fig. 4.5) and gradually descends to lower parts.

It was seen that there are two major blooming seasons commencing from March to June (Spring Aspect) and July to August (Summer Aspect). Autumn and winter aspects were poor in plants and flowering. Altitudinal gradient separate these seasons. Most of the species bloomed in 2nd spell (Summer Aspect) where 81.2% bloomed compared to 1st spell 30.7%. in lower parts i.e. foot hills had some species produced flowers at the onset of March and completed at mid of April. The mid hill and top hill vegetation bloomed at end of April and last to end of May. The phenological activities were early in the lower parts and with the ascend, they were delayed. Flowering was late in the upper parts. Generally, the spring and fall flushes were less intense than Sumer and winter was almost dormant.

Phenology is potentially a powerful tool for monitoring the response of plants to climatic change. In fact phenological observations are a valuable source of information for investigating the relationship between climate and weather variation and plant and animal development (Ahas *et al.*, 2002). The timing of phenological stages, such as leafing or flowering, and the onset of growing season, after the dormancy is released, are highly dependent on air temperature (Spark *et al.*, 2000). Flowering is the most significant phenological stages to evaluate the sensitivity of plants to climatic variability variability (Spano *et al.*, 1999). Spring flowers are strongly influenced by air temperature of the previous month. Higher air temperature values in spring indicates an earlier start of plant development within the year (Chmielewski & Rotzer, 2001). However the influence of temperature is not pronounced for autumnal phenological phases (Estrella, 2000). If

temperature is considered the driving factors of phenological timing in most climate areas, the effects of temperature needs to be adjusted incorporating functions for water availability (Kramer *et al.*, 2000). The use of standardized observation methods in phenology would help observer to accurately monitor plants and improve the quality of observation.

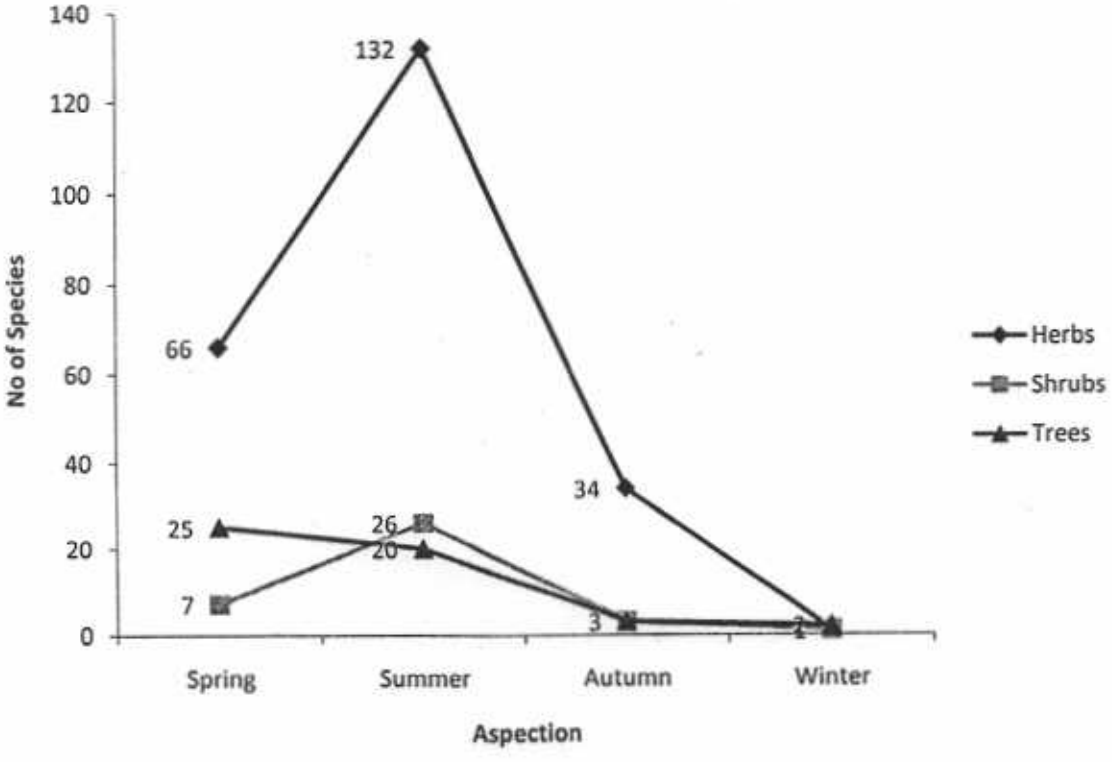
Many plants began to flowers earlier in urban than rural ones. The reason for later blooming is probably due to the climatic conditions including weather, edaphic factors. Warmer winter and spring temperature had been noted in the investigated valley. The earlier flowering in spring indicates the rising temperature. This has not only reduced the winter span but also had lost the moisture from soil and as a consequent diversity declined as happened in 2008-2009. In these sessions the region received little winter rain. Many plant flowers and fruit throughout the year except in drier area such as Dhali, Oona and some stands of Gumrush that are open and warm.

The inter annual change in spring, plant phenology may be the most sensitive and observable indicators of plant responses to climate change. The phenology of temperate zone forest is also mainly driven by temperature. Since temperate zone forests are mostly mixed deciduous forests in our case also, therefore, differences in phenological response may varied.

The functioning of trees is closely adapted to their local climate. Two mode of adaptation can be recognized: survival adaptation, which consider the tree ability to survive unfavorable circumstances and capacity adaptation, which refer to the features enabling the tree to use available resources affectively (Hanninen *et al.*, 1990). Phenology is an important feature of both types of adaptation as it marks the shift from the dormant, resistant stage to active, but more vulnerable stage in response to adverse environmental conditions. If a rapid climatic change occurs during the coming century that is within the life of currently living tree species, then these individuals may be less adapted to the prevailing climate. Furthermore if a tree species respond differently to a climate change, then the competitive relationships between species will alter, hence in the long run, the species composition of forests and possibly the geographical ranges of species.

It is obvious from the Fig. 4.5 that there were 56.4% herbaceous species in summer and 28.2 % in spring. 70.3 % during summer and 18.9 % in spring were shrubs. Trees contributed 51 % in spring and 40 .8 % in summer.

Fig. 4.5. Phenological behaviour of plants of Chakesar Valley, Shangla, Pakistan.



4.4.1. Herb-Woody Species Ratio

The ratio of herbs to woody plants was 1:02 i.e. herbs constituted 67.4% and woody plants comprised 32.6 % of the flora (Table 4.1; Fig.4.4).

The ratio of herbs to woody indicated that majority of plants were herbaceous and it revealed that anthropogenic activities had caused enormous changes in the land form, which has badly affectfloristic diversity. A change from woody to grassland has occurred.

4.4.2. Deciduous- Evergreen Ratio

The ratio of deciduous to evergreen flora was 57: 43 making 57.1 % deciduous and 42.9 % evergreen (Table 4.1; Fig.).

Kandao and Totash sites represent temperate forest, mixture of deciduous and evergreen trees while all other forests at lower altitude bear tropical and sub tropical vegetation. Deciduous species excell evergreen elements with 57.1% abundance in the surveyed sites. It is interesting to see that Gumrush hills has *Quercus* species forest on east facing and *Pinus* forest on west facing slope. The hill top had two natural ponds fed with rain water which is used it for domestic purposes by inhabitants. This area faces severe shortage of water.

4.4.3. Seasonal Ratio

The proportion of species in each season was 30.7 % (98) spring, 55.5 % (177) summer, 12.5 % (12.5) autumn and 1.3 % (4) winter (Table).

The seasonal ratio indicated that the altitudinal and latitudinal gradients demarcated different climatic zones with different vegetation that ranges from sub tropical (Oona hill and Dhali) in foot hills and mid hills to the tropical, subtropical and temperate forests. Generally spring prevailed short and summer last longer.

4.4.4. Ratio of light to shade plants

Based on light requirement there were 14.7 % sciophytes and 85.3 % heliophytes.

It was obvious that most of the plants were heliophytes. Sciophytes were confined to the in the lowere strata or cryptogamic species which were confined to the shady and moist pockects. Trees were light demanding and their canopy made the general canopy.

4.4.5. Stratification

Three strata could easily be recognized in the valley in most of sites. The stratification shows that the herbaceous layer consisted of (67.4 %) followed by thin

shrub layer composed by 13.2 % shrubby species. The tree layer was established by 15.7 5 plants.

The structure of vegetation is also defined by the stratification of vegetation. Study of the area demonstrated evident stratification of vegetation ranges from two layer (herbs and tree layer) to more complex arrangement with a herb strata, shrub and sapling strata and overall tree strata. It is one of the characteristics features of the tropical forests. Tall tree layer layer included *Pinus wallichiana, Pinus roxburghii and Abies pindrow*, median size strata consisted of *Acer oblongum*, Picea *smithiana, Alnus nitida* and small size tree included Acacia *nilotica, Acacia modesta, Morus nigra and Juglan regia*. Tall shrub layer made of *Robinia pseudocacia, Rubus fruiticosus, Rosa indica, Rosa macrophylla,* small shrub layer *Indigofera hetrantha, Berberis lycieum, Plectranthus rogusus*, herbaceous layer and cryptogamic layer.

Generally, except Kandao hill, all other hills had two strata vegetation at foot hill habitats and along the altitudinal gradient, it changes and top hills especially in Gumrush. Dhanakol and Kandao represent the complex stratification structure which is an important part for understanding.

4.4.6. Wild to Cultivated Species Ratio

As the area has several settlements, where agricultural practices are done. Thus 8.2 % plants cultivated plants and the remaining 91.8 % wild.

4.4.7. Aquatic –Non Aquatic Plant Ratio

As some streams and water bodies and moist habitats are present which support some aquatic plants? These include (9.1 %) species while the major bulk of 90.9 % of the flora was terrestrial. Some aquatic plants included *Ranunculus aquitalis, Polygonum barbatum, Polygonum glabrum, Nasturtium officinalis, Mentha longifolia* and *Eclipta alba.*

Table 4.1 Floristic composition with respect to its Phenology, Leaf persistence, Habitat and Stratification of plants of Chakesar Valley.

						Phenology				Leaf Persistence		Habitat		Storey Layer				Water requirement		Light requirements		Cultivation	
S.No	Name of the Plants	Family	Life F.	Leaf F.	Habit	Sp	Su	Au	Wi	D	E	Sh	S	T	S	H	C	Aq	Terr.	W	Hr	Cul	W
Fungi																							
1	*Morchella esculenta* Prs ex. fr.	Helveliaceae	Cr		F	-	-	+	-	+	-	-	+	F	F	F	F	-	+	F	F	-	+
Pteridophyta																							
1	*Adiantum incisum* Forsk.	Adian taceae	Cr	Na	H	-	-	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+
2	*Marsilia qudrifolia* L.	Marsileaceae	Cr	Mi	H	-	+	-	-	-	-	-	+	-	-	+	-	+		-	+	-	+
3	*Pteridium eqilinium* L.	Pteridaceae	Cr	Mi	S	-	-	-	-	-	+	+	-	-	+	-	-	-	+	-	-	-	+
4	*Aspidium* spp	Pteridaceae	Cr	Na	H	-	-	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+
5	*Asplenium* spp	Pteridaceae	Cr	Mi	H	-	-	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+
6	*Davallia denticulata* (Burm. f.) Mett. ex Kuhn	Pteridaceae	Cr	Mi	H	-	-	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+
7	*Pteris vitata* L.	Pteridaceae	Cr	Mi	H	-	-	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+
8	*Saliginella* spp.	Saliginellaceae	Cr	Mi	H	-	-	-	-	-	+	+		-	-	+	-	+	-	-	+	-	+
Gymnosperms																							
1	*Abies pindrow* Royle	Pinaceae	MeP	Lep	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+
2	*Picea smithiana* (Wall.) Boiss.	Pinaceae	MP	Lep	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+
3	*Pinus gerardiana* Wall. ex Lamb.	Pinaceae	MP	Lep	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+
4	*Pinus roxburghii* Sargent.	Pinaceae	MP	Lep	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+
5	*Pinus wallichiana* A. B. Jackson.	Pinaceae	MP	Lep	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+
Monocotyledons																							
1	*Allium humile* Kunth.	Alliaceae	Cr	Na	H	+	-	-	+	+	-	-	+	-	-	+	-	-	+	-	+	-	+
4	*Aristida cyanantha* Steud.	Poaceae	Th	Lep	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
5	*Aristida depressa* Retz.. Ohs.	Poaceae	Th	Lep	H	-	+	-	-	+	-	-	+	-	-	+	-	+	-	-	+	-	+
2	*Asparagus officinalis* L.	Asparagaceae	Cr	Lep	H	-	+	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+

3	*Asphodelous tennifolius* Cavan.	Asphodelaceae	Cr	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
6	*Avena sativa* L.	Poaceae	Th	Lep	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
24	*Brachiaria reptens* (L.) Stapf.	Poaceae	Th	Mi	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
7	*Bromus japonica* Thunb.	Poaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	+	-	-	+	-	+
8	*Bromus tectorum* L.	Poaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
9	*Cenchrus ciliaris* L.	Poaceae	H	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	+	-	-	+	-	+
10	*Chrysopogon aucheri* (Boiss.) Stapf	Poaceae	H	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
11	*Commelina bengalensis* L.	Commelinaceae	Cr	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	+	-	-	+	-	+
12	*Cynodon dactylon* (L.) Pers.	Poaceae	H	Lep	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
13	*Cyperus exaltatus* Retz.	Cyperaceae	Th	Lep	H	-	+	-	-	+	-	-	+	-	-	+	-	+		-	+	-	+
14	*Dactylis glomerata* L.	Poaceae	H	Mi	H	-	+	-	-	+	-	+	-	-	-	+	-	+	-	-	+	-	+
16	*Dichanthium annulatum* (Forssk.) Stapf.	Poaceae	H	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
17	*Eragrostis japonica* (Thunb.) Trin.	Poaceae	H	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
15	*Fimbristylis squarrosa* Vahl.	Poaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
18	*Hordeum vulgare* L.	Poaceae	Th	Mes	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
19	*Imperata cylindrica* (L.) Raeuschel	Poaceae	Cr	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
20	*Narcisus poeticus* Linn.	Amaryllidaceae	Cr	Ma	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
21	*Oryza sativa* L.	Poaceae	Th	Mes	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	+	-
22	*Pennisetum orientale* Rich.	Poaceae	Th	Mes	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
23	*Poa annua* L.	Poaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
25	*Saccharum munja* Roxb.	Poaceae	Ch	Mes	H	-	-	+	-	+	-	-	+	-	-	+	-	+	-	-	+	-	+
26	*Saccharum spontanum* L.	Poaceae	Ch	Mes	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
27	*Sorghum nephalensis* (L.) Hill.	Poaceae	Cr	Mes	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
28	*Sorghum nitidum* (Vahl) Pers.,	Poaceae	Cr	Mes	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
29	*Themeda anathera* (Nees ex Steud.) Hack.	Poaceae	H	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+		+
30	*Triticum aestivum* L.	Poaceae	Th	Mi	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	+	-
31	*Zea mays* L.	Poaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	+	-

Dicotyledons																								
1	*Abutilon indicum* Sweet.	Malvaceae	NP	Mes	S	+	-	-	-	-	-	-	+	-	+	-	-	-	+	+	-	-	+
2	*Acacia modesta* Wall.	Mimosaceae	MiP	Mi	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
3	*Acacia nilotica* (L.) Delile	Mimosaceae	MiP	Mi	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
4	*Acer oblongum* Wallich ex DC.	Aceraceae	MeP	Mi	+	-	+	-	+	+	-	-	+	+	-	-	-	-	+	+	-	-	+
5	*Achyranthes aspera* L.	Amaran thaceae	Ch	Mi	H	+	-	-	+	+	-	-	+	-	-	+	-	-	+	-	+	-	+
6	*Aconitum violata* Jacque. Staff.	Ranunculaceae	Cr	Mes	H	-	+	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+
7	*Acorus calamus* Linn.	Acoraceae	Th	Meg	H	-	-	-	+	-	+	-	+	-	-	+	-	+	-	-	+	-	+
8	*Adhatoda vasica* Nees	Acan thaceae	NP	Mi	S	-	+	-	-	+	-	-	+	-	+	-	-	-	+	+	-	-	+
9	*Aesculus indica* (Colebr. Ex Cambess.) Hook.	Hippocastanaceae	MeP	Mes	+	-	+	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+
10	*Ailanthus altissima* (Miller) Swingle	Simaroubaceae	MeP	Mi	+	+	-	-	-	+	+	-	+	+	-	-	-	-	+	+	-	-	+
11	*Ainsliaea aptera* DC.	Asteraceae	Ch	Mi	H	-	+	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
12	*Ajuga bracteosa* Wallich ex Benth.	Lamiaceae	Th	Mes	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
13	*Ajuga parviflora* Benth.	Lamiaceae	Th	Mes	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
14	*Alcea rosea* (Linn.) Cav.	Malvaceae	NP	Mes	S	+	-	-	-	+	-	-	+	-	+	-	-	-	+	-	-	-	+
15	*Alnus nitida* (Spach) Endl.	Be tulaceae	MiP	Ma	+	-	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
16	*Amaranthes spinosus* Linn.	Amaran thaceae	Th	Na	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
17	*Amaranthus caudatus* L.	Amaran thaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
18	*Amaranthus viridis* L.	Amaran thaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
19	*Ammi visnaga* (L.) Lam.	Apiaceae	Th	Lep	H	+	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	+	-
20	*Anagalis arvensis* Linn.	Primulaceae	Th	Mi	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
21	*Anagalis caerulea* (Schreb.) Gren. & Godr.	Primulaceae	Th	Mi	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
22	*Andrachne cordifolia* (Decne.) Mull. Arg.	Euphorbiaceae	NP	Mi	S	-	+	-	-	-	+	+		-	+	-	-	-	+	+	-	-	+
23	*Androsace rotundifolia* Hardw.	Primulaceae	Ch	Mi	S	-	-	-	-	-	+	+	-	-	+	-	-	-	+	+	-	-	+
24	*Anethum graveolens* Linn.	Apiaceae	Th	Lep	H	+	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	+	-
25	*Aquilegia pubiflora* Wallich ex Royle	Ranunculaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+

26	*Arenebia benthamii* (Wall.) ex G. Don.	Boraginaceae	Th	Mi	H	-	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
27	*Arisaema flavum* (Forssk.) Schott.	Araceae	Cr	Ma	H	-	+	+	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+
28	*Arisaema jacquemonti* Blume	Araceae	Cr	Meg	H	-	+	+	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+
29	*Arisaema utile* Hook. F, ex Schott.	Araceae	Cr	Ma	H	-	+	+	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+
30	*Artemisia dubia* Wall.	Asteraceae	Th	Lep	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
31	*Artemisia japonica* Thunb. Fl. Jap.	Asteraceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
32	*Artemisia santilifolia*	Asteraceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
33	*Artemisia scentonema*	Asteraceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
34	*Artemisia scoparia* Waldst. & Kit.	Asteraceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
35	*Artemisia vulgare* L.	Asteraceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
36	*Astragalus chlorostachys* Lindl.	Papilionaceae	Th	Lep	S	+	-	-	-	+	-	-	+	-	+	-	-	-	+	+	-	-	+
37	*Astragalus pyrrotrichus*	Papilionaceae	Th	Lep	S	+	-	-	-	+	-	-	+	-	+	-	-	-	+	+	-	-	+
38	*Barleria cristata* L.	Acan thaceae	Th	Mi	H	-	+	-	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+
39	*Berberis kunawarensis* Royle.	Berberidaceae	NP	Na	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
40	*Berberis lycium* Royle.	Berberidaceae	NP	Na	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
41	*Bergenia ciliata* (Haw) Sternb	Saxifragaceae	Cr	Mes	H	-	+	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+
42	*Boerhaavia diffusa* L.	Nyctaginaceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+		+	-	+
43	*Brassica campestris* Linn.	Brassicaceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	+	-
44	*Brassica napis* Linn.	Brassicaceae	Th	Mes	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	+	-
45	*Brassica oleracea* Linn	Brassicaceae	Th	Ma	H	-	-	+	-	-	+	-	+	-	-	+	-	-	+	-	+	+	-
46	*Broussonetia papyrifera* Vent.	Moraceae	MeP	Mes	+	-	+	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+
47	*Calendula arvensis* Linn.	Asteraceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
48	*Calendula officinalis* Linn.	Asteraceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
49	*Calotropis procera* (Ait.) Ait. F.	Asclepiadaceae	Ch	Mes	S	-	+	-	-	+	-	-	+	-	+	-	-	-	+	-	-	-	+
50	*Cannabis sativa* Linn.	Cannabaceae	Th	Na	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
51	*Capsella bursa pastoris* (L.) Medic.	Brassicaceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	+	-	-	+		+
52	*Capsicum annuum* Linn.	Solanaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+

53	*Carum carvi* Linn.	Apiaceae	Th	Lep	H	+	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	+	-
54	*Celtis australis* Wild.	Ulmaceae	MiP	Ma	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
55	*Centaurium centroide*	Gentianaceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
56	*Ceratium glomeratum* Thulli	Carryophylaceae	Th	Mi	H	-	-	+	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
57	*Chenopodium album* Linn.	Chenopodiaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
58	*Chenopodium caudatus*	Chenopodiaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	+	-	-	+	-	+
59	*Chenopodium murale* Linn.	Chenopodiaceae	Th	Mes	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
60	*Chrysanthemum leucanthemum* L.	Asteraceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
61	*Cichorum intybus* L.	Asteraceae	Th	Na	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
62	*Centaurea phyllocephala* Boiss.	Asteraceae	Th	Mi	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
63	*Cirsium wallichi* DC.	Asteraceae	Th	Na	H	-	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
64	*Citris medica* L.	Rutaceae	NP	Mi	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	+	+
65	*Citrullus vulgaris* (Thunb.) Matsum. & Nakai	Cucurbitaceae	Th	Mes	C	-	+	-	-	+	-	-	+	-	-	-	+	-	+	-	-	-	+
66	*Citrus acida* Brandis	Rutaceae	NP	Mi	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	+	-
67	*Citrus auritinum*	Rutaceae	NP	Mi	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	+	-
68	*Clematis grata* Wall.	Ranunculaceae	NP	Mi	H	-	+	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+
69	*Commelina bengalensis* L.	Commelinaceae	Cr	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	+	-	-	+	-	+
70	*Convolulus arvensis* L.	Convolulaceae	Th	Mes	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
71	*Conyza aegyptiaca* L.	Asteraceae	Th	Na	H	-	+	-	-	+	-	-	+	-	-	+	-	+	-	-	+	-	+
72	*Conyza bonariansis* (Linn.) Cronquist	Asteraceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	+	-	-	+	-	+
73	*Coriandrum sativum* Linn.	Apiaceae	Th	Na	H	+	+	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
74	*Cotoneaster nummularia* Fish & Mey	Rosaceae	Ch	Mi	S	-	-	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
75	*Cotoneaster nummularia* Fish &Mey	Rosaceae	NP	Na	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
76	*Cousinia thomsonii C. B. Clarke*	Asteraceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
77	*Crataegus oxycantha* L.	Rosaceae	Ch	Mi	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
78	*Crotolaria juncea* L.	Papilionaceae	Ch	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
79	*Cucumis sativus* Linn.	Cucurbitaceae	Th	Mes	C	-	+	-	-	+	-	-	+	-	-	-	+	-	+	-	-	+	-

80	*Cucurbita maxima* Duch.	Cucurbitaceae	Th	Meg	C	-	+	-	-	+	-	-	+	-	-	-	+	-	+	-	-	+	-
81	*Cucurbita pepo* Linn.	Cucurbitaceae	Th	Meg	C	-	+	-	-	+	-	-	+	-	-	-	+	-	+	-	-	+	-
82	*Cuscuta reflexa* L.	Cuscutaceae	Th	-	C	+	-	-	-	-	+	-	+	-	-	-	+		+	-	-	-	+
83	*Cyperus exaltatus* Retz.	Cyperaceae	Th	Lep	H	-	+	-	-	+	-	-	+	-	-	+	-	+		-	+	-	+
84	*Dalbergia sisso* Roxb.	Papilionaceae	MeP	Mi	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
85	*Daphne oloides* Schreb.	Thymeliaceae	NP	Mi	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
86	*Datura innoxia* Mill.	Solanaceae	Ch	Ma	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
87	*Debregetia salisifolia* (D. Don) Renle.	Urticaceae	Ch	Mi	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
88	*Delphinium ajacis* Linn.	Ranunculaceae	Th	Mi	H	-	-	+	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
89	*Delphinium denudatum* Wallich ex Hook. F.	Ranunculaceae	Th	Mi	H	-	-	+	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
90	*Desmodium elegans* DC.	Papilionaceae	NP	Mi	S	+	-	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
91	*Dianthus angulatus* Royle.	Carryophylaceae	Th	Na	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
92	*Diantus carryophyllus* Linn.	Carryophylaceae	Th	Na	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
93	*Dicliptra bupleuroides* Nees	Acan thaceae	Th	Mi	H	+	-	-	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+
94	*Dicliptra roxburghiana* Juss.	Acan thaceae	Th	Mi	H	+	-	-	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+
95	*Diospyrus kaki* Linn.	Ebenaceae	MiP	Mi	+	-	-	+	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
96	*Diospyrus lotus* Linn.	Ebenaceae	MiP	Mi	+	-	-	+	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
97	*Duchesnia indica* forsk.	Rosaceae	Th	Na	H	-	-	+	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
98	*Eclipta alba* Hassk.	Asteraceae	Th	Mi	H	-	+	-	-	-	+	+	-	-	-	+	-	+	-	-	+	-	+
99	*Eichornia crassipa* (Mart.) Solms	Pon tederiaceae	Cr	Meg	H	-	+	-	-	-	+	-	+	-	-	+	-	+	-	-	+	-	+
100	*Eremostachys thyrsiflora* Bunge in Ledeb..	Lamiaceae	Th	Ma	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
101	*Eriobotrya japonica* (Thumb.) Lindl.	Rosaceae	NP	Ma	H	+	-	-	-	+	+	-	+	-	-	+	-	-	+	-	+	-	+
102	*Eruca sativa* Mill.	Brassicaceae	Th	Mi	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	+	-
103	*Euphorbia granulata* L.	Euphorbiaceae	Th	Lep	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
104	*Euphorbia helioscopia* Linn.	Euphorbiaceae	Th	Mi	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
105	*Euphorbia hirta* L.	Euphorbiaceae	Th	Mi	H	-	-	+	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
106	*Euphorbia prostrata* Ait.	Euphorbiaceae	Th	Lep	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+

107	*Euphorbia wallichii* Hook. F.	Euphorbiaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
108	*Ficus bengalensis* Linn.	Moraceae	MiP	Mes	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
109	*Ficus carica* Linn.	Moraceae	MiP	Mes	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
110	*Ficus elastica* Roxb.	Moraceae	MiP	Mes	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
111	*Ficus palmata* Forssk.	Moraceae	MiP	Mes	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
112	*Ficus racemosa* Linn.	Moraceae	NP	Mes	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
113	*Ficus religiosa* Linn.	Moraceae	MiP	Mes	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+
114	*Foeniculum vulgare* Mill.	Apiaceae	Th	Na	H	+	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	+	-
115	*Fragaria vesica* Lindl.	Rosaceae	Th	Na	H	-	-	+	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
116	*Fumaria indica* (Haussk.)	Fumariaceae	Th	Lep	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
118	*Galium aparine* Linn.	Rubiaceae	Th	Lep	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
119	*Galium elegans* Wall.	Rubiaceae	Th	Lep	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
120	*Geranium rotundifolium* Linn.	Geraniaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
121	*Geranium wallichianum* D. Don.	Geraniaceae	Th	Mi	H	+	-	-	-	-	+	+		-	-	+	-	-	+	-	+	-	+
122	*Gerardiana palmata* (Forssk.)Gaud.	Urticaceae	Ch	Mi	S	-	+	-	-	+	-	-	+	-	+	-	-	-	+	+	-	-	+
123	*Gerbera gossypina* (Royle) Beauv.	Asteraceae	Th	Mi	H	-	-	+	-	-	+	+	+	-	-	+	-	+	-	-	+	-	+
124	*Geum elatum* L.	Rosaceae	Th	Mi	H	-	+	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+
125	*Gnaphalium hypoleucum* DC.	Asteraceae	Ch	Mes	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
126	*Grewia optiva* Drum. Ex Burret	tiliaceae	MiP	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
127	*Hedra helix* L.	Araliaceae	MiP	Mi	C	-	+	+	-	-	+	+	-	-	-	-	+	-	+	+	-	-	+
128	*Hedra nepalensis* K. Koch.	Araliaceae	MiP	Mi	C	-	+	+	-	-	+	+	-	-	-	-	+	-	+	+	-	-	+
129	*Heliotrophium ophioglossum* Stocks ex Boiss.	Boraginaceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
130	*Heliotropium strigosum* Willd.	Boraginaceae	Th	Na	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
131	*Hibiscus esculentus* L.	Malvaceae	Ch	Mes	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
132	*Hibiscus rosa chinensis* Linn.	Malvaceae	NP	Mes	S	-	+	-	-	+	-	-	+	-	+	-	-	-	+	-	-	-	+
133	*Hypericum perforatum* L.	Hypericaceae	Ch	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
134	*Imaptiens balsiminea* Linn.	Balsaminaceae	Th	Mi	H	-	+	-	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+

135	*Impatiens edgeworthii* Hk. F.	Balsaminaceae	Th	Mi	H	-	+	-	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+
136	*Impatiens gigantea* Egew.	Balsaminaceae	Th	Ma	H	-	+	-	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+
137	*Impatiens parviflora* DC.	Balsaminaceae	Th	Mi	H	-	+	-	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+
138	*Indigofera hetrantha* Wall.	Papilionaceae	Np	Na	S	-	+	-	-	+	-	-	+	-	+	-	-	-	+	+	-	-	+
139	*Inula grantioides* Boiss.	Asteraceae	Th	Mi	H	-	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
140	*Ipomea palmata* Forssk.	Convolulaceae	Th	Mes	C	-	+	-	-	-	+	-	+	-	-	-	+	-	+	-	-	-	+
141	*Ipomea purpura* (Linn.) Roxb.	Convolulaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
142	*Jasminum grandiflorum* L.	Oleaceae	NP	Mi	S	+	-	-	-	-	-	-	+	-	+	-	-	-	+	+	-	-	+
143	*Jasminum multiflorum* L.	Oleaceae	NP	Mi	S	+	-	-	-	-	-	-	+	-	+	-	-	-	+	+	-	-	+
144	*Juglan regia* L.	Juglandaceae	MiP	Mi	+	-	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
145	*Lathyrus aphaca* Linn.	Papilionaceae	Th	Na	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
146	*Lathyrus odoratus* Linn.	Papilionaceae	Th	Mi	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
147	*Lathyrus sativa* Linn.	Papilionaceae	Th	Mi	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
148	*Lepidium sativum* Linn.	Brassicaceae	Th	Mi	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
149	*Lespedeza juncea* (Linn. F.) Pers.	Papilionaceae	Th	Lep	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	+	-
150	*Lespedeza juncea* (Linn.f) Pers.	Papilionaceae	Th	Mi	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
151	*Leucas urticifolia* (Vahl.) R.Br. ex Sm.	Lamiaceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
152	*Linum usittisimum* L.	Linaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
153	*Luffa acutangula* (Linn.) Roxb.	Cucurbitaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
154	*Luffa aegyptica* Mill.	Cucurbitaceae	Th	Mes	C	-	+	-	-	+	-	-	+	-	-	-	+	-	+	-	-	+	-
155	*Luffa cylindrica* (Linn.) Roem.	Cucurbitaceae	Th	Mes	C	-	+	-	-	+	-	-	+	-	-	-	+	-	+	-	-	+	-
156	*Lycopersicum esculentum* Millers	Solanaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	-	+	-	+	-	-	+	-
157	*Malus pumila* Mill.	Rosaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	+	-
158	*Malva neglecta* Wallr.	Malvaceae	MiP	Mi	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
159	*Malvestrum coromandelianum* (Linn) Garoke.	Malvaceae	Th	Mi	H	-	+	-	-	-	-	-	+	-	-	+	-	-	+	-	+	-	+
160	*Medicago minima* (Linn.) Grufb	Papilionaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
161	*Medicago sativa* Linn.	Papilionaceae	Th	Lep	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
			Th	Lep	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+

162	*Megacodon stylophorus* (C. B. Clarke)	Gentianaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+		
163	*Melia azadarichta* Linn.	Meliaceae	MiP	Mi	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+		
164	*Melilotus alba* Desr.	Papilionaceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+		
165	*Mentha arvensis* L.	Lamiaceae	Cr	Mi	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+		
166	*Mentha longifolia* (L.) Hudson.	Lamiaceae	Cr	Mi	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+		
167	*Mentha piperata* Linn.	Lamiaceae	Cr	Mi	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+		
168	*Mentha viridis* Linn.	Lamiaceae	Cr	Mi	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+		
169	*Micromaria biflora* (Ham.) Benth.	Lamiaceae	Th	Na	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+		
170	*Momordica charantia* Linn.	Cucurbitaceae	Th	Mes	C	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+		
171	*Monotheca bauxifolia* (Fale) Dene ex. Engler	Sapotaceae	NP	Mi	S	-	+	-	-	-	+	-	+	-	+	-	-	+	-	+	-	-	+	-	
172	*Morus alba* Linn.	Moraceae	NP	Mi	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+		
173	*Morus laevigata* Wall.	Moraceae	MiP	Mes	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+		
174	*Morus nigra* L.	Moraceae	MiP	Mi	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+		
175	*Myrtus communis* Linn.	Myrtaceae	NP	Mi	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+		
176	*Narcisus poeticus* Linn.	Amaryllidaceae	Cr	Ma	H	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+		
177	*Coronopis didymus* L.	Brassicaceae	Cr	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+		
178	*Nasturtium officinalis* Linn.	Brassicaceae	Th	Ma	H	+	-	-	-	-	+	-	+	-	-	+	-	+		-	+	-	+		
179	*Nepeta clarkei* Hook.f.	Lamiaceae	Th	Mi	H	+	-	-	-	-	+	+		-	-	+	-	+	-	-	+	-	+		
180	*Nepeta erecta* (Benth.) Benth.	Lamiaceae	Th	Mi	H	+	-	-	-	+	-		+	-	-	+	-	-	+	-	+	-	+		
181	*Ocimum basilicum* Linn.	Lamiaceae	Ch	Mi	H	+	-	-	-	+	-	+	-	-	-	+	-	+	-	-	+	-	+		
182	*Olea ferruginea* Royle.	Oleaceae	MiP	Mi	+	-	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+		
183	*Origanum vulgare* Linn.	Lamiaceae	Ch	Mi	H	+	-	-	-	-	-	-	+	+	-	-	-	-	+	+	-	-	+		
184	*Oxalis corniculata* Linn.	Oxalidaceae	Th	Na	H	-	+	-	-	-	+	+	-	-	-	+	-	+	-	-	+	-	+		
185	*Oxalis corymbosa* DC.	Oxalidaceae	Cr	Na	H	-	+	-	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+		
186	*Oxalis pes-capre* Linn.	Oxalidaceae	Cr	Na	H	-	+	-	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+		
187	*Paeonia emodi* Wall.Hkf.	Paconiaceae	Cr	Mes	H	-	-	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+		
188	*Papaver somniferum* Linn.	Papaveraceae	Th	Mi	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+		

189	*Phlomis bracteosa* Royle	Lamiaceae	Th	Mi	S	-	+	-	-	+	-	-	+	-	+	-	-	-	+	-	-	-	+
190	*Pimpinella diversifolia* DC.	Apiaceae	Th	Mi	H	+	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
191	*Pisticia integrima* Stew ex. Brandis	Anacardiaceae	MiP	Mi	+	+	+	-	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+
192	*Pisum sativum* Linn.	Papilionaceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	+	-
193	*Plantigo lanceolata* Linn.	Plantiginaceae	Th	Mes	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
194	*Plantigo major* Linn.	Plantiginaceae	Th	Mes	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
195	*Plantigo ovata* Forssk.	Plantiginaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
196	*Platanus orientalis* Linn.	Plantinaceae	MP	Ma	+	-	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
197	*Plectranthus rugosus* Wall. ex Benth.	Lamiaceae	NP	Mi	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
198	*Podophylum emodi* Wall.	Podophyllaceae	Cr	Mes	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
199	*Polygonum aviculare* Linn.	Polygonaceae	H	Mes	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
200	*Polygonum barbatum* Linn.	Polygonaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	+	-	-	+	-	+
201	*Polygonum glabrum* Willd.	Polygonaceae	Th	Mi	H	-	+	-	-	-	+	+	-	-	-	+	-	+	-	-	+	-	+
202	*Polygonum plebejum* R. Br.	Polygonaceae	Th	Lep	H	+	-	-	-	-	+		+	-	-	+	-	-	+	-	+	-	+
203	*Portulaca oleracea* L.	Por tulacaceae	Th	Mes	H	-	-	+	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
204	*Prunella vulgaris* Linn.	Lamiaceae	Cr	Mi	H	+	-	-	-	+	-	+		-	-	+	-	+	V	-	+	-	+
205	*Prunus armeniaca* Linn.	Rosaceae	MiP	Mi	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
206	*Prunus bukharensis* Royle	Rosaceae	MiP	Mi	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
207	*Prunus persica* (Linn.) Batsh	Rosaceae	MiP	Mi	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
208	*Psidium guajava* L.	Myrtaceae	MiP	Mi	+	-	-	+	-	-	+	-	+	+	-	-	-	-	+	+	-	-	+
209	*Punica granata* L.	Punicaceae	MiP	Mi	+	+	-	-	-	-	+	-	+	+	-	-	-	-	+	+	-	+	-
210	*Pyrus communis* Linn.	Rosaceae	MiP	Mi	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
211	*Pyrus pashia* Ham.	Rosaceae	MiP	Mi	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
212	*Quercus baloot* Griff., Itin. Not.	Fagaceae	MeP	Mi	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
213	*Quercus dilatata* Lindl.	Fagaceae	MeP	Mi	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
214	*Quercus incana* Roxb.	Fagaceae	MeP	Mi	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
215	*Quercus lanata* Smith in Rees,	Fagaceae	MeP	Mi	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+

216	*Quercus semicarfifolia* Sm.	Fagaceae	MeP	Mi	+	-	+	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
217	*Ranunculus equitalis* L.	Ranunculaceae	Cr	Mes	H	-	-	+	-	-	+	+	-	-	-	+	-	+	-	-	+	-	+
218	*Ranunculus murricatus* Linn.	Ranunculaceae	Th	Mes	H	-	-	+	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
219	*Robinia pseudocacia* Linn.	Papilionaceae	MiP	Mi	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
220	*Rosa indica* L.	Rosaceae	Ch	Mi	S	+	-	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
221	*Rosa macrophylla* Lindl.	Rosaceae	NP	Mi	S	+	-	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
222	*Rosa webbiana* Wallich ex Royle.	Rosaceae	NP	Mi	S	+	-	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
223	*Rubia cordifolia* Linn.	Rubiaceae	Th	Lep	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
224	*Rubus ellipticus* Smith.	Rosaceae	NP	Mi	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
225	*Rubus foliolosus* D. Don	Rosaceae	NP	Mi	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
226	*Rubus fruticosus* L.	Rosaceae	NP	Mi	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
227	*Rubus sanctus* Schreb.	Rosaceae	NP	Mi	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
228	*Rumex acetosa* L.	Polygonaceae	Th	Mes	H	-	-	+	-	-	+	+	-	-	-	+	-	+	-	-	+	-	+
229	*Rumex dentatus* Linn.	Polygonaceae	Th	Mes	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
230	*Rumex hastatus* D. Don..	Polygonaceae	Ch	Mes	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
231	*Rumex naphalensis* Sprengel	Polygonaceae	Th	Mes	H	-	+	-	-	+	-	+	-	-	-	+	-	+	-	-	+	-	+
232	*Rumex persicaria* L.	Polygonaceae	Th	Mes	H	-	+	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+
233	*Salix babylonica* L.	Salicaceae	MiP	Mi	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
234	*Salix tetrasperma* Roxb. Pl. Corom.	Salicaceae	MiP	Mi	+	+	-	-	-	+	-	-	+	+	-	-	-	-	+	+	-	-	+
235	*Salvia lanata* Roxb	Lamiaceae	Cr	Mes	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
236	*Salvia moorcroftiana* Wall.	Lamiaceae	Th	Ma	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
237	*Salvia nubicola* Wall.	Lamiaceae	Th	Mes	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
238	*Sarcococca saligna* (D.Don) Muell.	Buxaceae	NP	Na	S	-	+	-	-	-	+	+	-	-	+	-	-	-	+	+	-	-	+
239	*Sauromatum venosum* (Aiton) Kunth	Araceae	Cr	Meg	H	-	+	+	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+
240	*Saussoria albescens* (DC)Sch. Bip	Asteraceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
241	*Segeretia thea* (Osbeck) M.C. Johnson.	Rhamnaceae	NP	Na	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
242	*Senecio chrysanthemoides* DC.	Asteraceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+

243	*Seriphidium stenocephalum* (Krasch. ex Poljakov) Poljakov.	Asteraceae	NP	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
244	*Silene conoide* Linn.	Carryophylaceae	Th	Na	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
245	*Silene vulgaris* (Moench) Garcke	Carryophylaceae	Th	Na	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
246	*Sisymbrium irio* Linn.	Brassicaceae	Th	Ma	H	+	-	-	-	+	-	-	+	-	-	+	-	+	-	-	+	-	+
247	*Solanum melongena* Linn.	Solanaceae	Th	Mes	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	+	-
248	*Solanum nigrum* L.	Solanaceae	Th	Mi	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
249	*Solanum pseudocapsicum* L.	Solanaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
250	*Solanum surretensis* Burm. f.	Solanaceae	Th	Mes	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
251	*Solanum villosum* Mill.	Solanaceae	Th	Mi	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
252	*Sonchus arvensis* (DC) Kirp.	Asteraceae	Th	Mi	H	-	-	+	-	-	+	-	+	-	-	+	-	+	-	-	+	-	+
253	*Spirea lindleyana* Wall.	Rosaceae	Ch	Na	S	-	-	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
254	*Stachys emodi* Hedge	Lamiaceae	Ch	Mi	S	-	+	-	-	+	-	-	+	-	+	-	-	-	+	+	-	-	+
255	*Stachys seriaca* Wall. ex Benth.	Lamiaceae	Ch	Mi	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
256	*Stellaria media* (L.) Vill.	Carryophylaceae	Th	Na	H	-	-	+	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
257	*Tagetes erecta* Linn.	Asteraceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
258	*Taraxicum officinale* Weber	Asteraceae	Th	Ma	H	-	-	+	-	-	+	-	+	-	-	+	-	+	-	-	+	-	+
259	*Thalictrum pendunculatum* Edgew.	Ranunculaceae	Th	Mes	H	-	+	-	-	-	+	+	-	-	-	+	-	-	+	-	+	-	+
260	*Thymus serphylum* Benth.	Lamiaceae	Ch	Mi	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
261	*Trichodesma indica* (L.) R. Br.	Boraginaceae	Th	Na	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
262	*Trifolium alexandrium* Linn.	Papilionaceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
263	*Trifolium repense* Linn.	Papilionaceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
264	*Trigonella foenum-graecum* Linn.	Papilionaceae	Th	Mi	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
265	*Urtica dioica* Linn.	Urticaceae	Th	Mi	H	-	+	-	-	+	-	+	-	-	-	+	-	-	+	-	+	-	+
266	*Urtica hyperborea* L.	Urticaceae	Th	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
267	*Valeriana*	Valerianaceae	Cr	Mes	H	+	-	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
268	*Verbascum thapsis* L.	Schruphulariaceae	Th	Ma	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
269	*Vibernum grandiflorum* Wall. Ex DC.	Caprifoliaceae	MiP	Mes	S	-	+	-	-	+	-	-	+	-	+	-	-	-	+	+	-	-	+

270	*Vicia faba* Linn.	Papilionaceae	Th	Lep	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
271	*Vicia hirsuta* (L.) S. F. Gray	Papilionaceae	Th	Lep	H	+	-	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
272	*Vigna vexillata* (L.) A.Rich.	Papilionaceae	Ch	Mi	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
273	*Viola biflora*L.	Violaceae	Th	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
274	*Viola serpens* Wall. Ex Roxb.	Violaceae	Cr	Mi	H	-	+	-	-	-	+	-	+	-	-	+	-	-	+	-	+	-	+
275	*Withania somnifera* L.	Solanaceae	Ch	Mes	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+
276	*Woodfordia fruticosa* (L.) Kurz.	Ly thraceae	Ch	Mi	S	-	+	-	-	-	-	-	+	-	+	-	-	-	+	+	-	-	+
277	*Xanthium strumarium* Linn	Asteraceae	Th	Ma	H	-	+	-	-	+	-	-	+	-	-	+	-	-	+	-	+	-	+
278	*Zanthoxylum armatum* DC.	Rutaceae	NP	Na	S	-	+	-	-	-	+	-	+	-	+	-	-	-	+	+	-	-	+

Key Words: Life F. = Life form, Leaf F. = Leaf form, Habit, Sp = Spring, Su = Summer, Au = Autumn, Wi = Winter, D = Decidous, E = Evergreen, Sh = Sciophytes, S = Heliophytes, T = Trees, S = Shrubs, H = Herbs, C = Climber Aq = Aquatic, Terr. = Terrestrial, W = Woody, Hr = Herbaceous, Cul.= Cultivated, W = Wild, Th = Therophytes, Cr = Cryptophytes, HCr = Hemicryptophytes, Ch = Chameophytes, MIP = Microphanerophytes, NP = Nanophanerophytes, MeP = Mesophanerophytes, Meg = Megaphanerophytes, Mi = Microphyll, Na = Nanophyll, Ma = Macrophyll, Mes = Mesophyll and LP = leptophyll.

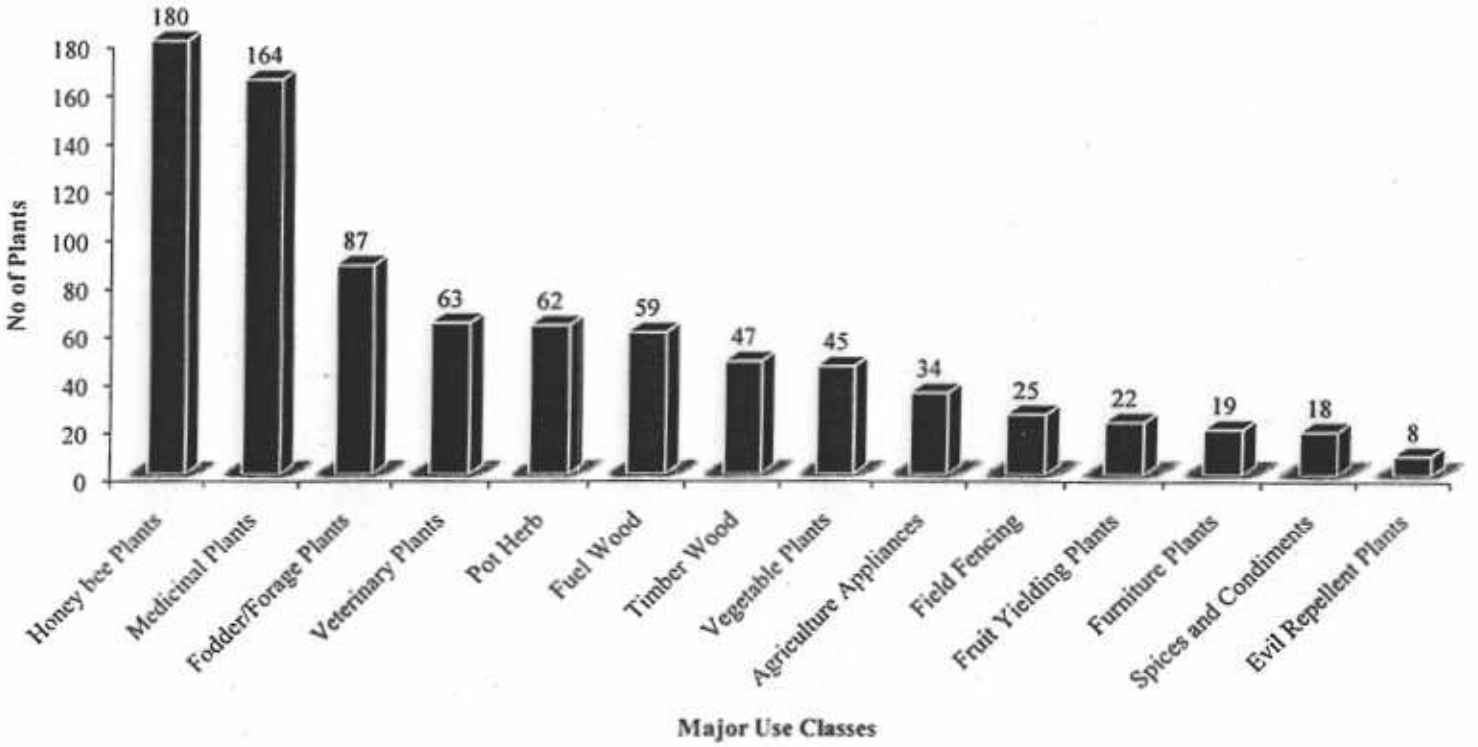
Ethnobotanical Potential of Chakesar Valley

The valley possesses a very rich ethnobotanical heritage in the far plunge area. Even today, the inhabitants are using various plant species for various purposes.

The results showed that the local people use all the 319 recorded plant species belonging to 85 families and 215 genera for variety of purposes (Table 4.4). The ethnobotanically important plants included 278 dicotyledons, 28 monocotyledons, 8 pteridophytes and 5 gymnosperms. It was observed that major utility of plants i.e. 164 (51.4%) species turned out to be medicinal plants. The next important use of 87 (27.3%) species was fodder purposes. There were 59 (18.5%) fuel species, 47 (14.7%) timber wood, 45 (14.1%) vegetable species, 63 (19.8%) veterinary use plants and 62 (19.4%) vegetables. Some 180 (56.4%) species were visited by honey bees. The fruit plants included 22 (6.9 %) species, 18 (5.6%) species yield spices and condiments while 34 (10.6%) species were used for making agricultural appliances. Some 25 (7.9%) are used for fencing field borders and 19 (5.9%) are used for making furniture. Eight (2.5%) species were considered mythological and superstition species (Table 4.4; Fig. 4.10).

It was documented that the locals used plants for simple or multiple purposes. Most of the plants had multiple uses. These multipurposes plants included *Pisticia integrima* (8 local uses), *Acacia modesta, Brassica compestris, Ficus palmata* and *Solanum nigrum* each of them had 7 local uses, *Acacia nilotica, Ailanthus altissima, Capsicum annuum, Coriandrum sativum, Ficus carica, Juglan regia, Lepidium sativum, Linum usittisimum, Melia azadarichta, Morus alba, Olea ferruginea, Punica granata, Zanthoxylum armatum* had (6 local uses). There were 5 recoded uses for *Alnus nitida, Amaranthus viridis, Berberis kunawarensis* and *Berberis lycium*. The list included both cultivated and non cultivated species. Similarly Durrani *et al.* (2009) recorded 124 ethnobotanically important plant species in Chilton National Park. The list

Fig. 4.10. Percentage Composition of Ethnobotanically important Plants of Chakesar Valley, District Shangla.



included 98 fodder species, 40 medicinal and 18 were used as fuel wood. Families like Poaceae and asteraceae were the most important families. Our study recorded 164 medicinally important plants (51.4 %) in the valley.

1. Plants used in Traditional Health Care Sysytem

Every plant has some medicinal value. The local residents partly rely on the medicinal plants for curing different ailments. The present study documented 164 medicinally important plants which make 51.4% of the local flora. Some most important medicinal plants commonly used in the area are *Pisticia integrima, Acacia modesta, Lepidium sativum., Linum usittisimum, Zanthoxylum armatum, Amaranthus viridis, Berberis kunawarensis, Berberis lyceum, Chenopodium caudatus, Chenopodium murale, Eruca sativa, Hedera helix, Acorus calamus, Althea rosea, Bergenia ciliata, Foeniculum vulgare, Grewia optiva., Hypericum perforatum, Indigofera hetrantha., Mentha arvensis, Nasturtium officinalis, Trigonella foenum-graecum, Ajuga bracteosa, Ajuga parviflora, Ammi visnaga, Arisaema flavum, Cichorum intybus, Duchesnia indica, Fumaria indica, Hedra nepalensis, Lespedeza juncea, Paeonia emodi, Thymus serphylum, Vibernum grandiflorum, Viola serpens, Aconitum violata, Artemisia dubia, Artemisia vulgare, Asparagus officinalis, Calotropis procera, Cannabis sativa, Clematis grata, Cynodon dactylon, Cyperus exaltatus, Datura innoxia, Salvia lanata, Thalictrum pendunculatum, Polygonum aviculare, Valeriana* species and *Withania somnifera.*

The commercially important medicinal plants included *Pisticia integrima, Zanthoxylum armatum, , Berberis lyceum, Hedera helix, Bergenia ciliata, Hypericum perforatum, Ajuga bracteosa, Lespedeza juncea, Paeonia emodi, Viola serpens, Aconitum violata, Artemisia dubia, Clematis grata, Datura innoxia, Salvia lanata, Thalictrum pendunculatum, Morchella esculenta* and *Valeriana.* The results agree with Sher & Hussain (2009) who documented inventory of medicinal plants of Malam Jaba and reported 50 recipes belonging to 30 families. Their findings agree with the present study. Durrani *et al.* (2003), Durrani & Hussain (2005), Durrani & Manzoor (2006), Shah *et al.* (2006), Hussain *et al.* (2006), Ibrar *et al.* (2007, Hussain *et al.* (2007), Ahmad *et al.* (2008) and Qureshi *et al.* (2008) also reported useful medicinal plants from various parts of the country. Our results regarding medicinal uses were them. Razaq *et al.* (2010) also documented similar ethnobotanical work from nearby Changa Valley District Shangla. They reported 50 plant species of medicinal

importance and some of them have been recorded in the present study. They also stated the importance of *Morchella esculenta* in the valley. Ozturk *et al.* (2008) described nearly 500 plants used for primary health care. El- Darier & El-Mogaspi (2009) reported 44 plants used for cold, asthma, kidney problems, skin inflammation, liver and hypertension. Similar to our results Rout *et al.* (2009) also reported 48 plants used in folk medicines. Hussain *et al.* (2010) described 88 plants of medicinal values. Dahare & Jain (2010) also investigated 47 medicinal plants used by traditional herbal healers. Hossen *et al.* (2010) stated that healer use medicinal plants as their primary source of medicinal formulation as rural patients for curing urinary infections and sexually transmitted diseases. Hussain *et al.* (2008) reported 40 medicinal plants included some of the presently listed species. The findings agree with those of Khan *et al.* (2008) who documented 98 plants of medicinal values; Qureshi *et al.* (2009) reported 28 species used by local women. Hamayun (2003) described 44 species for curing diseases from the neighboring with similar uses. Ali & Qaiser (2009) explained 83 taxa having indigenous use from Hunza. Adnan *et al.* (2010) reported 300 plants used as medicines which also support our findings. The people of the valley are poor and those living in the remote pocket depend on the used medicinal plants according to Naveed & Begum (2009) stated that crude drugs are prepared in form of paste, decoction, infusion, juice, powder pills and water extract. Species of *Artemisia* such as *Artemisia dubia* Wall. *Artemisia japonica* Thunb., Fl. Jap., *Artemisia santilifolia, Artemisia scentonema, Artemisia scoparia* Waldst. & Kit. and *Artemisia vulgare* L. had multiple medicinal values. Our results in line those of Ashraf *et al.* (2010), who described uses of *Artemisia* having folk therapeutic plants in northern area of Pakistan. Barakatullah *et al.* (2009) described ethnobotany of Charkotli Hill.

The investigated valley is a backward area and the lack basic health facilities. The residents depend on folk traditional uses of medicinal plants. Generally, the elders, particularly women were more knowledgeable about traditional uses of plants. The vendors collect, dry plants and sell them. These people have rich experience in curing health problems through plants

Since valley is floristically rich there it had also diverse plants of medicinal importance. They desire that if government should support them financially for cultivation of medicinal plants as novel crop.

2. Fodder species

Heady, (1995) defined fodder species as the plant materials primarily leaves and

stem wild or grown for either direct consumption or stored for feeding of ruminants. The result revealed that there are 87 (27.3%) species are being used as fodder of livestock which includes cattles, goat and sheep. The important fodder species *Aristida cyanantha, Aristida depressa, Avena sativa, Brachiaria reptens, Bromus japonica, Bromus tectorum, Cenchrus ciliaris, Chrysopogon aucheri, Cynodon dactylon, Dactylis glomerata, Dichanthium annulatum, Fumaria indica, Imperata cylindrica, Ipomea palmata, Medicago sativa, Melilotus alba, Oryza sativa, Oxalis corniculata, Oxalis corymbosa, Pennisetum orientale, Poa annua, Rumex dentatus, Rumex hastatus, Themeda anathera, Trifolium alexandrium, Trifolium repense*, and *Zea mays*.

Grasses and herbaceous plants are abundant in summer. The local harvest the grasses for storing them for later use during winter. A number of fodder species are valued to them due to high nutritive value that are preferred preference by cattle, sheep and goat. The highly valued fodder species that they store for winter season included *Aristida cyanantha, Aristida depressa, Avena sativa Bromus tectorum, Cenchrus ciliaris, Chrysopogon aucheri, Cynodon dactylon, Dactylis glomerata, Dichanthium annulatum, Eragrostis japonica, Imperata cylindrica Oryza sativa, Pennisetum orientale, Sorghum nepalensis, Sorghum nitidum, Themeda anathera* and *Zea mays*.

Most of them belonged to family poaceae. Our findings agree with Hussain *et al.* (1996) who reported that *Convolulus arvensis* is used as fresh fodder and purgative in Swat. It is also recorded in the study area and has same uses. Dilshad *et al.* (2009) documented 25 fodder species similar to the present finding used for some cattle diseases. Sardar & Khan (2009) also recorded many fodder species. Yousaf & Sajjad (2002) mentioned 42 fodder species while Hamayun *et al.* (2004) listed 33 fodder species in Utror and Gabral Valleys. Barakatullah *et al.* (2009) mentioned 18 fodder or forage species from Charkotli Hills, Batkhela District. All the above workers had mentioned the same fodder species but only some of them used in the valley and responsible for high yield of milk. Ibrar *et al.* (2007) also recorded 37 forage species from Ranyal hill, District Shangla.

3. Fuel wood Species

59 species (18.5%) to the local flora (Fig. 4.13) cater the needs of fuel wood of the locals. These species are ruthlessly used by the inhabitants due to lack of gas facility and some other alternate source. The fuel wood species include *Abies*

pindrow, *Acacia modesta*, *Acacia nilotica* , *Ailanthus altissima*, *Debregetia salisifolia*, *Ficus bengalensis*, *Grewia optiva*, *Melia azadarichta*, *Morus alba*, *Morus laevigata*, *Morus nigra*, *Olea ferruginea*, *Picea smithiana*, *Pinus gerardiana*, *Pinus longifloia*, *Pinus wallichiana*, *Platanus orientalis*, *Plectranthus rugosus*. *Prunus persica*, *Punica granata*, *Quercus baloot*, *Quercus dilatata*, *Quercus incana*, *Quercus lanata*, *Quercus semicarfifolia*, *Robinia pseudocacia*, *Salix babylonica*, *Salix tetrasperma*, *Sarcococca saligna*, *Segeretia thea*, *Vibernum grandiflorum*, *Woodfordia fruticosa* and *Zanthoxylum armatum*. *Ailanthus altissima*, *Melia azadarichta*, *Abies pindrow*, *Picea smithiana*, *Pinus gerardiana*, *Pinus longifloia*, *Pinus wallichiana*, *Pisticia integrima*, *Platinus orientalis*, *Quercus baloot*, *Quercus dilatata*, *Quercus incana*, *Quercus lanata* and *Quercus semicarfifolia* having high fuel value and are therefore preferred. The population of these species has reduced at alarming rate and is now limited only to the top hill or found in accessible spots.

In spite of advances in Sciences and creation of new sources of fuel energy, plant resources still remain major foundation of fuel wood and fire wood in most of the developing countries, including Pakistan. The daily hike in modern fuel, lack of availability, low production might be some reasons of exploitation of fuel wood. Siddique and Ayaz (1998) described that low income and sub standard of living compelled the people to depend on traditional uses. It is strengthened by the present study. The results showed that 59 species of plants were being used as fuel wood in the area, which included trees, shrubs and herbs. Mishra & Verma (1995) reported 50 fuel wood species n India. Toledo (1996) further listed that 80 species consisting 20 species of trees used as fuel wood by the local people. Singh & Pandey (1998) described that more than 60 species were used by the people of Rajistan, India for burning purposes due easily availability and access. All these findings agree with our results because plants still the easy, freely available source in the valley. Also in the area, more than 75 % people depend upon surrounding forests for fire wood collection.

In winter, temperature drops to freezing level with regular snow fall in the upper reaches life activities become confined to homes only. The locals have categorized fuel wood species on the basis of easy availability and heat value. They preferred those species which produce less smoke, burn for longer time and have high heat value such as *Pinus wallichiana*, *Olea ferruginea*, *Morus alba*, *Cedrus deodara*, *Abies pindrow* and *Pinus roxburghii*. Some people smuggle them from surrounding

peaks of mountains as these species vanished in nearby mountains due to ruthless cutting.

4. Timber wood Species

Timber wood is the major source of earning livelihood in the area. All construction materials is obtained from nearby forest resources. In the present it was seen that timber wood was obtained from 47 (14.73%) species which includes *Abies pindrow*, *Acacia modesta*, *Acasia nilotica*, *Acer oblongum*, *Ailanthus altissima*, *Alnus nitida*., *Broussonetia papyrifera*, *Celtis australis*, *Crataegus oxycantha*, *Dalbergia sisso*, *Melia azadarichta*, *Morus alba*, *Myrtus communis*,*Olea ferruginea*, *Picea smithiana*, *Pinus gerardiana*, *Pinus roxburghii*, *Pinus wallichiana*, *Pisticia integrima*, *Platinus orientalis*, *Quercus baloot*, *Quercus dilatata*, *Quercus incana*, *Quercus lanata*, *Quercus semicarfifolia*, *Robinia pseudocacia*, *Salix babylonica* and *Salix tetrasperma*. The most valued timber wood species are *Abies pindrow*, *Juglan regia*, *Melia azadarichta*, *Morus alba*, *Olea ferruginea*, *Picea smithiana*, *Pinus gerardiana*, *Pinus roxburghii*, *Pinus wallichiana*, *Quercus baloot*, *Quercus dilatata*, *Quercus incana*, *Quercus lanata* and *Quercus semicarfifolia*(Table 4.4).

Wood is used by mankind for construction since long. Although industries and other synthetic materials replacing wood in many cases, yet in this remote valley wood is early available and cheap source of construction. The quality of timber wood species varies due to density, appearance, structure, strength and durability. Various physical properties like fragrance, color, appearance of woods are helpful in traditional identification of timber wood. The present study recognized 14 plant species as mentioned above due to durability and resistance to termites. Some timber species like *Olea ferruginea* has small stature and is heavier. It was observed in India, that Pinus species were more resistance to termites (Parihar, 1997). The people had also trend to use *Ailanthus altissima* as timber wood and its use is increasing due to unavailability of other species. They preferred it because of its durability, weight and resistance to termites and other pest attack. Iqbal (1977) reported 13 timber woods used by local of Ghalegy, Swat, supported our view and Khan, (1998) had also similar results from Gokand valley, Buner and he reported 7 species including *Morus* and *Pinus* species were prominent timber in the area. Hamayun *et al.* (2005) recorded 8 timber wood species from Utror and Gabral Valley District Swat. Deka *et al.* (2007) discussed ten indigenous fuelwood species. Fuel value index depends upon calorific

value, density, moisture and ash content of wood is an important parameter for screening desirable fuel wood species. Fast drying rate and the ability to reproduce hot flame were the quality criterion most frequently used by the respondent in ranking the preferred fuel wood species. Fuel wood is the largest source for three quarters of the world population who live in developing countries (Scurlock & Hall, 1990). Some influential people are involved in smuggling and have permanent source of income are supported by some government official. The government owned forests declined at rapid rate than those of owned by the locals.

5. Vegetables Species

Forty five species used as vegetables (14.11%) by the inhabitants. There are 22 (6.89 %) wild vegetables in the valley. They include *Pisticia integrima Solanum nigrum, Amaranthus viridis, Chenopodium murale, Taraxicum officinalis, Trifolium alexandrium, Trifolium repense, Chenopodium album, Medicago minima, Nasturtium officinalis, Portulaca oleracea, Rumex dentatus, Rumex naphalensis, Vicia faba, Vicia hirsuta, Lathyrus aphaca, Lathyrus sativa, Medicago sativa* and *Oxalis corniculata.* Among cultivated vegetables there are 23 (7.11 %) vegetables cultivated in the valley. These include *Capsicum annum, Coriandrum sativum, Lepidium sativum, Linum usittisimum, Brassica napis, Brassica oleracea, Lycopersicum esculentum, Solanum melongena, Trigonella foenum-graecum, Cucurbita maxima, Cucurbita pepo, Luffa acutangula, Luffa aegyptica., Luffa cylindrica, Pisum sativum, Hordeum vulgare* and *Momordica charantia.* Vegetables form an integral part of the economy and culture. There are a variety of culinary species. It included leaves of *Pisticia integrima* (Locally called Shani) *Solanum nigrum* (Locally called Kachmacho), *Amaranthus viridis* (Locally called Ganhar), *Chenopodium murale* (Locally called Lanray), *Medicago minima* (Locally called Peshtary), *Nasturtium officinalis, Portulaca oleracea* (Locally called Warkharay), *Rumex dentatus*(Locally called Shalhay) and *Oxalis corniculata*(Locally called Taroki). These vegetabes are generally called Saag and are very delicious especially the young shoot of Youngs are unaware and have poor knowledge about wild vegetables, so it is important to save these knowledge of traditional delicious food. Similar work were reported by Ahmad *et al.*(2004), Hamayun (2005) and Shinwari & Shah(1996) and that strengthened the present findings.

Lycopersicum esculentum, Solanum melongena, Cucurbita maxima, Cucurbita pepo, Luffa acutangula, Luffa aegyptica., Luffa cylindrica, and *Momordica*

charantia are regularly cultivated in the area. *Cucurbita maxima* boiled and eaten with maize bread and Shoomley. This is the favoured food of older of the area. Locally Halwa is also made of it and is a popular recipe. The following all agree with our works. They all have similar findings. Durrani *et al.*,2009; Akhtar & Begum, 2009; Razaq *et al.*, 2010; Ibrar *et al.*, 2007; Badshah & Hussain, 2011; Barakatullah *et al.*, 2009; Alam *et al.*, 2011; Hazart *et al.*, 2011, Qureshi *et al.*, 2006; Sher & Hussain, 2009; Sher *et al.*, 2011; Khan *et al.*, 2007; Awan *et al.*, 2001; Ahmad *et al.*, 2006; Kamal *et al.*, 2009; Wazir *et al.*, 2007 and Zabihullah *et al.*, 2006 in this respect.

6. Medicinal Plants of Veterinary importance

Plants are used for the medication of livestock by local healer and elder persons. The local used 63 plants (19.7%) species for treating cattles, goats, sheep, cats and dogs for curing various ailments. Majority of plants are used for curing stomach disorders. These plants included both wild and cultivated. The most important wild species 51 (80.95 %) used for this purposes included *Pisticia integrima, Acacia modesta, Solanum nigrum, Acasia nilotica, Juglan regia, Morus alba, Punica granatum, Zanthoxylum armatum, Alnus nitida, Amaranthus viridis, Berberis kunawarensis, Berberis lycium, Dalbergia sissio, Hedra helix, Pinus longifloia, Abutilon indicum, Acorus calamus, Alcea rosea, Asphodelous tennifolius, Bergenia ciliata, Boerhaavia diffusa, Hypericum perforatum, Indigofera hetrantha, Medicago minima, Mentha arvensis, Mentha longifolia, Mentha piperata, Mentha viridis, Rumex dentatus, Ajuga bracteosa, Ajuga parviflora, Allium humile, Carum carvi, Cichorum intybus, Commelina bengalensis, Fumaria indica, Galium aparine, Galium elegans, Hedra nepalensis, Lespedeza juncea, Paeonia emodi, Podophylum emodi, Viola serpens, Achyranthes aspera, Adiantum incisum, Anagalis arvensis, Brachiaria reptens, Fragaria vesica, Megacodon stylophorus, Polygonum barbatum* and *Gerbera gossypina.*

Among the cultivated 12 (19.15 %) serve for veterinary medication. These plants are *Brassica compestris, Capsicum annum, Coriandrum sativum, Lepidium sativum, Linum usittisimum, Eruca sativa, Trifolium alexandrium, Trifolium repense, Foeniculum vulgare, Ammi visnaga, Avena sativa* and *Hordeum vulgare.*

The local community generally depends on their livestock for earning livelihood. They had free rangelands where animals grazed. Mouth and foot disease is very common. They used *Zanthoxylem armatum* leaves and seeds for its treatment.

Similarly animal fever i.e. common in cattle and is treated by *Salvia moorcroftiana.* Many such studies have also been done on the ethnobotany of medicinal and other useful Plants. These included (Singh *et al.*, 1997; Siwakoti & Siwakoti, 1998; Mustafa *et al.*, 2000; Siddiqui *et al.*, 2000; Durrani *et al.*, 2003). Bonet & Valles (2007) discussed the plants used in veterinary medicines. In the ethnopharmacology, veterinarian practices and plant use are still continuo even in developed countries (Pieroni, 1999; Viegi *et al.*, 2003) because livestock and agriculture are interrelated. Hamayun *et al.*(2005) discussed 18 veterinary medicinal plants of Utror & Gabral valley. Many such studies have also been conducted on Ethnobotany. The ethnobotany of some parts of Swat has also been reported (Hussain *et al.*, 1995; Hussain & Sher.1998; Sher *et al.*, 2003, 2004; Hussain *et al.*,2004, 2005). The present study reports the traditional utilization of plants of Chakesar as no reference on the ethnobotany exists from this remote area.

This is the first attempt to elucidate and explore the ethnoveterinary medicinal plants in the area. This practice is continuo since long ago. It is a dire need to preserve the knowledge and similarly Ishtiaq *et al.* (2002) reported 54 species used to treat various diseases of pet animals from Saahni valley District Bhumber, Azad Kashmir. Some of the plants with almost similar uses are the same as reported by the present study.

8. Honey bee plants

The bulk of flora i.e. 180 plants (56.43%) species are honey bee is important product of the area and almost each home in the valley is associated with apiculture. It is a source of food and income in the valley. The locals rear honey bees in walls of their rooms and home. The most preferred species are included *Acacia modesta, Brassica compestris, Ailanthus altissima, Coriandrum sativum, Lepidium sativum, Linum usittisimum, Melia azadarichta, Zanthoxylum armatum, Berberis kunawarensis, Berberis lycium, Dalbergia sisso, Eruca sativa, Pyrus communis, Pyrus pashia, Quercus semicarfifolia, Robinia pseudocacia, Salix babylonica, Salix tetrasperma, Trifolium alexandrium, Trifolium repense, Aesculus indica, Althea rosea, Bergenia ciliata, Foeniculum vulgare, Grewia optiva, Hypericum perforatum, Indigofera hetrantha, Lathyrus odoratus, Mentha arvensis, Mentha longifolia, Mentha piperata, Mentha viridis, Prunus armeniaca, Prunus bukharensis, Prunus persica, Adhatoda vasica, Ajuga bracteosa, Ajuga parviflora, Desmodium elegans, Duchesnia indica, Jasminum multiflorum, Lathyrus aphaca, Lathyrus sativa, Paeonia emodi,*

Pisum sativum., Rosa indica, Rosa macrophylla, Rosa webbiana ,Rubus foliolosus, Rubus fruticosus, Artemisia dubia, Hibiscus rosa chinensis, Jasminum grandiflorum and *Verbascum thapsis.*

Apiculture is a source of income of the people of the valley. It is self a medicine and is very sacred in Muslim community. It is a useful and a common practice in the area. It play a vital role in the economy of the people. It is common due to the honeybee flora. Most of the people rear the honey bee as a source of income and food. Each house holds 10 kg on average during the spring and summer season. They sell it for Rs. 250 to Rs. 750/kg depending upon the quality which is depend on flowers. Honey obtained from *Acacia modesta, Zanthoxylum armatum, Pyrus communis, Pyrus pashia* is considered in the area and is sold at high prices in between 750-1000/kg.

The wild honey produced has more valued that rear in houses. The prices of honey fluctuate during different seasons of the year and its availability. It is sold 100 - 200 times more expensive than domesticated bees. Honey production is quite high and they focus to use it a permanent income source. Its productivity depends on the availability of flowers. In 2008-09, due to low rainfall and prevailing drought, its production also decreases. Rehman (1997) reported 130 honeybee plants from Peshawar and adjoining area. Hamayun (2005) reported 8 species from Atror and Gabral valley. Zabihullah *et al.*(2006) reported 5 species, Iqbal & Hamayun (2003) reported 31 species from Hindukush Himalayan region Malam Jaba. It needs to provide scientific basis to this small scale industry. Workshops and training programme should be arranged for the people to improve the health conditions of bees, quality of honey. It is also suggested to encourage the formation of hives in open places from where extraction is easy and simple. Moreover wooden boxes should be used that help to take care of proper health, honey extraction in right time in right place that lead to increase honey production. It is suggested to improve the collection, packing and marketing method of honey.

9. Fruit Yielding Plants

The locals get fruit from 22 (6.9%) species. Some of the fruits are also exported to the neighbor districts like Swat, Hazara and Bunir and also to various parts of the country. Among them there are 16 (72.27 %) species of wild plants; they include *Diospyrus lotus, Ficus carica, Juglan regia, Morus alba, Punica granata, Diospyrus kaki, Morus laevigata, Morus nigra, Pyrus communis, Pyrus pashia, Malus*

pumila, *Diospyrus kaki*, *Diospyrus lotus* and *Fragaria vesica*. There are 6 (27.27 %) species of cultivated fruit plants including *Psidium guajava*, *Citris medica*, *Citrus acida*, *Citrullus vulgaris*, *Citrus auritinum* and *Duchesnia indica*.

People do not know proper collection, processing and packing of these valuable fruits. Moreover there is urgent need not only to preserve the wild species but also to improve budding and grafting. It is important to conserve these species and to enhance its cultivation. Lubna, (2001) described that forests in Pakistan covered 4.8% area of land. Ali & Tor (2004) said that forest resources are under pressure from deforestation and subsequent land degradation. Hamayun *et al.*(2005) recorded 19 fruit yielding plants from Utror and Gabral valley, district Swat. Sher & Al-Yemni (2011) recorded 14 wild fruit species from higher altitude coniferous forest of Malam Jaba, Swat. Ibrar *et al.*(2009) also recorded 18 edible species from Ranyal Hill, Shangla. These workers also reported the plants recorded in the present study. These are ecologically and climatically similar to the present study.

The government should encourage the locals to improve cultivars of fruits in the Chakesar valley to improve the living of people and alleviate poverty. Fruit plants are a major source of livelihood and this can up lift socioeconomic status of the locals of the valley. A better quality variety management and making is needed.

10. Spice and Condiment Species

In Chakesar Valley 18 (5.6%) plant species are being used as spices, condiments and flavoring agents. Some of them are exported to various parts of the country. These species are *Ammi visnaga*, *Anethum graveolens*, *Brassica compestris*, *Capsicum annum*, *Carum carvi*, *Eruca sativa*, *Foeniculum vulgare*, *Lepidium sativum*, *Linum usittisimum*, *Lycopersicum esculentum*,

Mentha arvensis, *Mentha longifolia*, *Mentha piperata*, *Mentha viridis*, *Prunus armeniaca*, *Prunus bukharensis*, *Punica granata* and *Zanthoxylum armatum*.

These species are probably used in every home. They store them and make their dishes spicy especially in certain festivals and at arrival of guests. They used seeds of *Brassica compestris*, *Lepidium sativum*, *Linum usittisimum* and *Capsicum annum* in making pickles. They also dired *Lycopersicum esculentum*, make powder and then used in making dishes of rice. Sher *et al.*(2011) reported 4 species used as spice and condiments. Ibrar *et al.*(2007) also reported 2 species used as spice and condiments by local. These all findings show that no work has been done in this aspect. It is

coincidence that these species also have medicinal values and as such they fulfill diet purposes.

11. Species Used For Making Agricultural appliances

Agriculture is the back bone of the area. The locals have small farmlands which are cultivated with using indigenous agricultural tools. They use donkey, bullocks and buffalos to plough in their fields. Various agriculturists applicants are made of *Acacia modesta, Ficus palmata, Acacia nilotica, Ailanthus altissima, Ficus carica, Juglan regia, Melia azadarichta, Morus alba, Olea ferruginea, Alnus nitida, Dalbergia sisso, Ficus bengalensis, Ficus religiosa, Morus laevigata, Morus nigra, Picea smithiana, Pinus roxburghii, Pyrus communis, Pyrus pashia, Quercus baloot, Quercus dilatata, Quercus incana, Quercus lanata, Quercus semicarpifolia, Salix babylonica, Salix tetrasperma, Abies pindrow, Aesculus indica, Ficus racemosa, Grewia optiva, Pinus gerardiana, Pinus wallichiana* and *Platanus orientalis*.

Some of the appliances used in agriculture practices are spade, hoe, harrows, rake, trowel and scythe and larger implements such as plough and larger racks that are either drawn by human or animals. Zabihullah *et al.* (2006), Rashid & Marwat (2005), Sher *et al.* (2011), Ibrar *et al.*(2007), Sher and Al-Yemni (2011), Hamayun *et al.*(2005) and Durrani *et al.*(2009) had also reported plants used in making variety of tools for agriculture. It is universal to have wooden tools or partly wooden tools for traditional agriculture uses. The wood may differ in different parts of Pakistan for the same use.

The wood of Quercus species is used for making plough and handles of axes. These are needed to work in the field.

12. Plants used For Fencing Field

People protect their fields and crops by fencing the borders by using 25 (7.8%) species. Such as *Acacia modesta*, Acacia *nilotica, Ailanthus altissima, Zanthoxylum armatum, Berberis kunawarensis, Berberis lycium. Plectranthus rugosus, Rubus ellipticus, Rubus sanctus, Segeretia thea, Adhatoda vasica, Citrus acida, Monotheca bauxifolia, Rosa indica, Rosa macrophylla, Rosa webbiana, Rubus foliolosus, Rubus fruticosus, Rumex hastatus, Citrus auritinum, Sorghum nephalensis, Sorghum nitidum, Saccharum munja* and *Saccharum spontanum*. Mostly spiny and bush making species are preferred. This type of fencing materials is cheap and lasts long. Once plant it remains for year. The available work in this respect are of Zabihullah *et al.* (2006), Rashid & Marwat (2005), Sher *et al.* (2011), Ibrar *et al.*(2007), Sher and

Al-Yemni (2011), Hamayun *et al.*(2005), Durrani *et al.*(2009) and Barakatullah *et al.*(2009). Who reported similar use of plants from the adjoining areas?

Field fencing is common near permanent settlement in order to protect their field from grazing, shortcut path.

13. Furniture plants

Locally furniture is made from 19 (5.9%) species (Table 4.4; Fig.4.10). The most valued species for making futniture are *Abies pindrow*, *Alnus nitida*, *Juglan regia*, *Melia azadarichta*, *Picea smithiana*, *Pinus roxburghii*, *Pinus wallichiana*, *Pisticia integrima* and *Salix tetrasperma*, *Quercus baloot*, *Quercus dilatata*, *Quercus incana*, *Quercus lanata*, *Quercus semicarfifolia*, *Salix babylonica and Juglan regia*.. Furniture made in this valley is sold to outside districts. The findings agrees with Zabihullah *et al.* (2006), Sher *et al.* (2011), Ibrar *et al.*(2007), Sher and Al-Yemni (2011), Hamayun *et al.*(2005), Durrani *et al.*(2009) and Barakatullah *et al.*(2009). Who also reported almost similar utility of similar plants from nearby valleys?

Furniture industry is also running in traditional way. The locals are expert in carving the furniture. Wood of *Juglan* is durable and best for carving. A sample bed made of walnut wood cost Rs. 3000, that Piecea Rs. 4500, Cedrus Rs. 7000.

14. Evil repellent plants

The traditional societies in the remote area firmly believe in myths and superstitions. In the same context 8 (2.5%) species are considered as evil repellent, superstitionally with some mythologies. These plants include *Ficus palmata*, *Olea ferruginea*, *Ocimum basilicum*, *Allium humile*, *Arisaema flavum*, *Aconitum violate*, *Arisaema jacquemonti* and *Arisaema utile*, Ficus *palmata* is considered a sacred plant mentioned in the Holy Quran and its cutting is prohibited. It is believed that if someone finds fig flowers, collect and store in the box, it will change everything to the gold iin the home. Thus seeing fig flowers will make them richer. *Arisaema flavum* rhizome is placed below the pot of yogurt with assumption that it will bring and collect butter from the surrounding houses and increase its fat contents. Sher *et al.* (2011), Ibrar *et al.*(2007), Sher and Al-Yemni (2011), Hamayun *et al.*(2005), Durrani *et al.*(2009) and Barakatullah *et al.*(2009). The above had also reported similar myths in different areas.

15. Quranic Plants

The flora also includes some plants that have been mentioned in the Holy Quran. These plants were divided into three groups on the basis of use. These include the following species with the translation of related Aya of Quran.

The present research work included four herbaceous vegetables mentioned in the Holy Quran and Ahadith. These are:

a. Vegetable

1. ***Allium cepa* L.**, English Name: Onion, Local Name: Piaz
2. ***Allium sativum* L.**, English Name: Garlic, Local Name: Lehsan.

Reference from Holy Quran (Para 1; Surah Baqra 1, Verse No. 68).

And when you said, "O Moses, we will not remain content with one food, pray then to your Lord, that He bring forth for us of what the earth grows, some vegetables and cucumbers and wheat and lentils and onions," said, "Do you demand inferior thing in exchange of the superior?" Well get down in Egypt or in any city, there you shall get that which you demanded, and humiliation and poverty were stamped upon them and drew-in the wrath of Allah. This was in lieu of their refusal of the Signs of Allah and slaying the prophets unjustly. This was due to their disobedience and transgression".

3. ***Trigonella foenum - graecum* L.** English Name: Garlic, Local Name: Lehsan.

References from Al-Hadith (Ghaznavi, 1991).

"Qasim Bin Abdul Rehman (R.A.) narrates that Rasulluh (Peace Be Upon Him) said, "seek cure by (Using) fenugreek". In other hadith Rasulluh (Peace Be Upon Him) said. "if my followers knew the importance of the fenugreek then they will buy it by gold of equal weight" (Ghaznavi, 1991).

4. ***Zingiber officinale* Roscoe.** English Name: Ginger, Local Name: Adrak.

References from Holy Quran

"Therein, they shall be made to drink a cup whose mixture will be ginger".

5. ***Cucurbita maxima* L.** English Name: Squash, Local Name: Peta Kado.

References from Holy Quran (Para 30; As-Saaffat, Verse No 146).

"And We caused to grow over him a tree of gourd" The study revealed 7 fruit plants mentioned in the Holy Quran and Al- Hadith. These are:

6. ***Punica granatum* L.** English Name: Pomegranate, Local Name: Anar.

References from Holy Quran (Para 5; Surah Al-An'am Verse No 141).

"And it is He who has sent down water from the heaven, then We brought forth every things of growth and out of it We brought forth the green (foliage) from

which We bring forth-clustered grains and out of the sheaths of palms the bunches close to one another and gardens of grapes and olives and pomegranates, similar in some respect and dissimilar in some other respects. Look at its fruit when it bears fruit and its ripening. Undoubtedly there are signs in it for the persons believing" (Para 5; Surah Al-An'am Verse No 99).

"And it is He who has produced gardens, trellised and untrellised, and date palms and filth in which are various kinds of food and olives and pomegranates similar in some respects and dis-similar in some other respects. Eat of their fruits when bear fruits and pay due thereof on the day of harvesting, and spend not wastefully. Undoubtedly, He does not like those who spend wastefully"

"In them, there are fruits dates and pomegranates. Which then, of the favors of your Lord will you deny"?(Surah Ar-Rahman Verse No 68, 69).

7. ***Ficus carica* L.** English Name: Figs, Local Name: Anjeer.

References from Holy Quran (Para 30; Surah Teen, Verses No 1-4).

"By the Fig and the Olive. And by Mount Sinai. And by this city of Security. Undoubtedly, We have made man in the fairest stature"

8. ***Olea europea* L.** English Name: Olive, Local Name: Zaithoon.

References from Holy Quran (Para 30; Surah Al-An'am, Verse No 99).

"And it is He who has sent down water from the heaven, then We brought forth every things of growth and out of it We brought forth the green (foliage) from which We bring forth-clustered grains and out of the sheaths of palms the bunches close to one another and gardens of grapes and olives and pomegranates, similar in some respect and dissimilar in some other respects. Look at its fruit when it bears fruit and its ripening. Undoubtedly there are signs in it for the persons believing".

9. ***Ocimum bacilicum* L.,** English Name: Sweet Basil, Local Name: Kashmalay

References from Holy Quran (Para 28; Surah Rahman, Verses No 12-13).

"And grain with husk and fray rant flowers. Which then, of the favors of your Lord wills O Jinn and men you twain will deny"?

This study revealed that *Allium cepa* L., *Allium sativum* L., *Trigonella foenum graecum* L. *Zingiber officinale* Roscoe. *Cucurbita maxima* L. *Punica granatum* L. *Ficus carica* L. *Olea europea* L and *Ocimum bacilicum* L. have mentioned in Holy Quran. Shafaghat (2010) investigated phytochemical properties of Quranic fruits and plants. According to him 18 sampled showed flavinoids, 9 showed the presence of alkaloids, 10 tannins and 10 saponins. Marwat *et al.* (2009) described 15 aromatic

plant species belonging to 14 genera of 10 families, mentioned in the Holy Quran and Ahadith and their ethnomedicinal importance. *Acorus calamus, Artemesia maritima, Citrus* species and *Ocimum bacilicum* reported were also present in our research area. Hazart Muhammad (Peace be Upon Him) recommended *Acorus calamus* for the treatment of pimple (Al-Qadri, 2007). In the Holy Quran it is said."Your God is that who has made different kinds of orchids and gardens for you, those have colorful crops of dates, olive and pomegranate. Their shapes and tastes are similar as well as different also. Eat these fruits when ripe but keep the share of poor relatives and needy and do not waste them (Holy Quran: 141, Surah Al- An'am). Olive plant has many references in the Holy Quran. It is used for skin diseases and baldness (Ahmad *et al.*, 2009). Marwat *et al.* (2009) studied nine herbaceous vegetables mentioned in the Holy Quran and Ahadith. *Cucumis sativus* also has many references in Ahadith. It dispels heat and is diuretic (Marwat,*et al.*, 2009). According to Abu-Darda (Radiallaho Anho) some one presented figs to the Prophet Muhammad (PBUH) and he began distributing it among his followers. HE said: "Eat it as it cures various diseases" (Marwat,*et al.*, 2009). The fruit is mildly laxative, demulcent, digestive and pectoral. The unripe green fruits are cooked with other foods as a galactogogue and tonic (Marwat,*et al.*, 2009).

Olive is a useful tree. Its name has been mentioned in most of the Holy Books like Taurat, Injeel, Zaboor and Quran Majeed. The Holy Prophet has narrated."use olive oil in your meals and also use it for massage". *Punica granatum* is a good food and medicine of great value. It is a tonic for heart patients. It is very effective in stomach and heart pain. The juice is excellent cooling beverage and allays thirst.

Allium sativum has been held in high esteem for its health building qualities for centuries. It contains high percentage of minerals and vitamins. It also contains traces of iodine, sulphur and chlorine. It is recgarde as rejuvenator. Garlic contains a wealth of sulfur compounds, most important for the taste of Allicin. Gourd has also special importance in Ahadith. It is advised to use gourd oil for the treatment of diseases of brain and blood pressure for year (Marwat,*et al.*, 2009). Similarly fenugreek has much used in herbal medicine. It has a wide range of medicinal applications. It is apowerful tonic and helpful in backache. The seeds in powdered form also used in diabetes (Marwat *et al.*, 2009 ; Ahmad *et al.*,2004).

Table 4.4. Ethnobotanical Profile of Plants of Chakesar Valley, District Shangla.

No	Species	MP	FP	FW	TW	Vg	PH	VP	HB	FYP	SC	AA	FF	FP	ERP
1	*Abies pindrow* Royle	-	-	+	+	-	-	-	-	-	-	+	-	+	-
2	*Abutilon indicum* Sweet.	+	-	-	-	-	+	+	+	-	-	-	-	-	-
3	*Acacia modesta* Wall.	+	-	+	+	-	-	+	+	-	-	+	+	-	-
4	*Acacia nilotica* (L.) Delile.	+	-	+	+	-	-	+	-	-	-	+	+	-	-
5	*Acer oblongum* Wallich ex DC.	+	-	+	+	-	-	-	-	-	-	-	-	+	-
6	*Achyranthes aspera* L.	+	-	-	-	-	-	+	-	-	-	-	-	-	-
7	*Aconitum violata* Jacque. Staff.	+	-	-	-	-	-	-	-	-	-	-	-	-	+
8	*Acorus calamus* Linn.	+	-	-	-	-	+	+	+	-	-	-	-	-	-
9	*Adhatoda vasica* Nees	+	-	-	-	-	-	-	+	-	-	-	+	-	-
10	*Adiantum incisum* Forsk.	-	-	-	-	-	+	+	-	-	-	-	-	-	-
11	*Aesculus indica* (Colebr. Ex Cambess.) Hook.	-	-	+	-	-	-	-	+	-	-	+	-	+	-
12	*Ailanthus altissima* (Miller) Swingle	-	+	+	+	-	-	-	+	-	-	+	+	-	-
13	*Ainsliaea aptera* DC.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	*Ajuga bracteosa* Wallich ex Benth.	+	-	-	-	-	-	+	+	-	-	-	-	-	-
15	*Ajuga parviflora* Benth.	+	-	-	-	-	-	+	+	-	-	-	-	-	-
16	*Allium humile* Kunth.	-	-	-	-	-	-	+	+	-	-	-	-	-	+
17	*Alnus nitida* (Spach) Endl.	-	-	-	+	-	-	+	+	-	-	+	-	+	-
18	*Alcea rosea* (Linn.) Cav.	+	-	-	-	-	+	+	+	-	-	-	-	-	-
19	*Amaranthes spinosus* Linn.	+	-	-	-	-	-	-	-	-	-	-	-	-	-
20	*Amaranthus caudatus* L.	+	+	-	-	-	-	-	-	-	-	-	-	-	-
21	*Amaranthus viridis* L.	+	+	-	-	+	+	+	-	-	-	-	-	-	-
22	*Ammi visnaga* (L.) Lam.	+	-	-	-	-	-	+	-	-	+	-	-	-	-
23	*Anagalis arvensis* Linn.	-	+	-	-	-	-	+	-	-	-	-	-	-	-
24	*Anagalis caerulea* (Schreb.) Gren. & Godr.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	*Andrachne cordifolia* (Dcne.) Mull. Arg.	-	-	-	-	-	-	-	+	-	-	-	-	-	-
26	*Androsace rotundifolia* Hardw.	-	-	-	-	-	-	-	+	-	-	-	-	-	-
27	*Anethum graveolens* Linn.	-	-	-	-	-	-	-	-	-	+	-	-	-	-
28	*Aquilegia pubiflora* Wallich ex Royle	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	*Arenebia benthamii* (Wall.) I. M. Johnston	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	*Arisaema flavum* (Forssk.) Schott.	+	-	-	-	-	-	-	+	-	-	-	-	-	+
31	*Arisaema jacquemonti* Blume	-	-	-	-	-	-	-	+	-	-	-	-	-	+
32	*Arisaema utile* Hook. F. ex Schott.	-	-	-	-	-	-	-	+	-	-	-	-	-	+
33	*Aristida cyanantha* Steud.	-	+	-	-	-	-	-	-	-	-	-	-	-	-
34	*Aristida depressa* Retz., Ohs.	-	+	-	-	-	-	-	-	-	-	-	-	-	-
35	*Artemisia dubia* Wall.	+	-	-	-	-	-	-	+	-	-	-	-	-	-

36	*Artemisia japonica* Thunb., Fl. Jap.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
37	*Artemisia santilifolia*	+	-	-	-	-	-	-	+	-	-	-	-	-	-
38	*Artemisia scentonema*	+	-	-	-	-	-	-	+	-	-	-	-	-	-
39	*Artemisia scoparia* Waldst. & Kit.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
40	*Artemisia vulgare*L.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
41	*Asparagus officinalis*	+	-	-	-	-	+	-	-	-	-	-	-	-	-
42	*Asphodelous tennifolius* Cavan.	+	-	-	-	-	+	+	+	-	-	-	-	-	-
43	*Aspidium* spp	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	*Asplenium* spp	-	-	-	-	-	-	-	-	-	-	-	-	-	-
45	*Astragalus chlorostachys* Lindl.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
46	*Astragalus pyrrotrichus* L.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
47	*Avena sativa* L.	-	+	-	-	-	-	+	-	-	-	-	-	-	-
48	*Barleria cristata* L.	-	+	-	-	-	-	-	-	-	-	-	-	-	-
49	*Berberis kunawarensis* Royle.	+	-	+	-	-	-	+	+	-	-	-	+	-	-
50	*Berberis lycium* Royle.	+	-	+	-	-	-	+	+	-	-	-	+	-	-
51	*Bergenia ciliata* (Haw) Sternb	+	-	-	-	-	+	+	+	-	-	-	-	-	-
52	*Boerhaavia diffusa* L.	-	+	-	-	-	+	+	+	-	-	-	-	-	-
53	*Brachiaria reptens* (L.) Stapf.	-	+	-	-	-	-	+	-	-	-	-	-	-	-
54	*Brassica compestris* Linn.	+	+	-	-	+	+	+	+	-	+	-	-	-	-
55	*Brassica napis* Linn.	-	+	-	-	+	+	-	+	-	-	-	-	-	-
56	*Brassica oleracea* Linn	-	+	-	-	+	+	-	+	-	-	-	-	-	-
57	*Bromus japonica* Thunb.	-	+	-	-	-	-	-	-	-	-	-	-	-	-
58	*Bromus tectorum* L.	-	+	-	-	-	-	-	-	-	-	-	-	-	-
59	*Broussonetia papyrifera* Vent.	-	-	-	+	-	-	-	+	-	-	-	-	-	-
60	*Calendula arvensis* Linn.	-	-	-	-	-	-	-	+	-	-	-	-	-	-
61	*Calendula officinalis* Linn.	-	-	-	-	-	-	-	+	-	-	-	-	-	-
62	*Calotropis procera* (Ait.) Ait. F.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
63	*Cannabis sativa* Linn.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
64	*Capsella bursa pastoris* (L.) Medic.	-	+	-	-	-	-	-	+	-	-	-	-	-	-
65	*Capsicum annuum* Linn.	+	-	-	-	+	+	+	+	-	+	-	-	-	-
66	*Carum carvi* Linn.	-	-	-	-	-	-	+	+	-	+	-	-	-	-
67	*Celtis australis* Wild.	-	-	-	+	-	-	-	+	-	-	-	-	+	-
68	*Cenchrus ciliaris* L.	+	+	-	-	-	-	-	-	-	-	-	-	-	-
69	*Centaurium centroide*	+	-	-	-	-	-	-	-	-	-	-	-	-	-
70	*Ceratium glomeratum* Thulli	-	+	-	-	-	-	-	-	-	-	-	-	-	-
71	*Chenopodium album* Linn.	-	+	-	-	+	+	-	+	-	-	-	-	-	-
72	*Chenopodium caudatus* L.	+	+	-	-	+	+	-	+	-	-	-	-	-	-
73	*Chenopodium murale* Linn.	+	+	-	-	+	+	-	+	-	-	-	-	-	-
74	*Chrysanthemum leucanthemum* L.	+	-	-	-	-	-	-	+	-	-	-	-	-	-

75	*Chrysopogon aucheri* (Boiss.) Stapf	+	+	-	-	-	-	-	-	-	-	-	-	-	-	
76	*Centaurea phyllocephala* Boiss.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
77	*Cichorum intybus* L.	+	-	-	-	-	-	+	+	-	-	-	-	-	-	
78	*Cirsium wallichi* DC.	+	-	+	-	-	-	-	+	-	-	-	-	-	-	
79	*Citris medica* L.	-	-	+	-	-	-	-	+	+	-	-	-	-	-	
80	*Citrullus vulgaris* (Thunb.) Matsum. & Nakai	-	-	-	-	-	-	-	+	+	-	-	-	-	-	
81	*Citrus acida* Brandis	-	-	-	-	-	-	-	+	+	-	-	+	-	-	
82	*Citrus auritinum*	-	-	-	-	-	-	-	-	+	-	-	+	-	-	
83	*Clematis grata* Wall.	+	-	-	-	-	-	-	+	-	-	-	-	-	-	
84	*Commelina bengalensis* L.	+	-	-	-	-	-	+	+	-	-	-	-	-	-	
85	*Convolulus arvensis* L.	+	+	-	-	-	-	-	+	-	-	-	-	-	-	
86	*Conyza bonariansis* (Linn.) Cronquist	+	+	-	-	-	-	-	+	-	-	-	-	-	-	
87	*Conyza egyptica* Ait.	+	+	-	-	-	-	-	-	-	-	-	-	-	-	
88	*Coriandrum sativum* Linn.	+	+	-	-	+	+	+	+	-	-	-	-	-	-	
89	*Cotoneaster nummularia* Fish & Mey	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
90	*Cajanus cajan* L.	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
91	*Cousinia thomsonii C. B. Clarke*	+	-	-	-	-	-	-	+	-	-	-	-	-	-	
92	*Crataegus oxycantha* L.	+	-	-	+	-	-	-	+	-	-	-	-	-	-	
93	*Crotolaria juncea* L.	+	-	-	-	-	-	-	+	-	-	-	-	-	-	
94	*Cucumis sativus* Linn.	-	-	-	-	-	-	-	+	-	-	-	-	-	-	
95	*Cucurbita maxima* Duch.	-	-	-	-	+	+	-	+	-	-	-	-	-	-	
96	*Cucurbita pepo* Linn.	-	-	-	-	+	+	-	+	-	-	-	-	-	-	
97	*Cuscuta reflexa* L.	+	-	-	-	-	-	-	+	-	-	-	-	-	-	
98	*Cynodon dactylon* (L.) Pers.	+	+	-	-	-	-	-	-	-	-	-	-	-	-	
99	*Cyperus exaltatus* Retz.	+	+	-	-	-	-	-	-	-	-	-	-	-	-	
100	*Dactylis glomerata* L.	-	+	-	-	-	-	-	-	-	-	-	-	-	-	
101	*Dalbergia sissoo* Roxb.	-	-	+	+	-	-	+	+	-	-	+	-	-	-	
102	*Daphne oleoides* Schreb.	+	-	-	-	-	-	-	+	-	-	-	-	-	-	
103	*Datura innoxia* Mill.	+	-	-	-	-	-	-	+	-	-	-	-	-	-	
104	*Davallia denticulata* (Burm. f.) Mett. ex Kuhn	-	-	-	-	-	+	-	-	-	-	-	-	-	-	
105	*Debregetia salisifolia* (D. Don) Renle.	+	-	+	-	-	+	-	+	-	-	-	-	-	-	
106	*Delphinium ajacis* Linn.	-	-	-	-	-	-	-	+	-	-	-	-	-	-	
107	*Delphinium denudatum* Wallich ex Hook. F.	-	-	+	-	-	-	-	-	-	-	-	-	-	-	
10	*Desmodium elegans* DC.	+	+	-	-	-	-	-	+	-	-	-	-	-	-	

8															
109	*Dianthus angulatus* Royle.	-	+	-	-	-	-	-	+	-	-	-	-	-	-
110	*Diantus carryophyllus* Linn.	-	+	-	-	-	-	-	+	-	-	-	-	-	-
111	*Dichanthium annulatum* (Forssk.) Stapf.	-	+	-	-	-	-	-	-	-	-	-	-	-	-
112	*Dicliptra bupleuroides* Nees	-	+	-	-	-	-	-	-	-	-	-	-	-	-
113	*Dicliptra roxburghiana* Juss.	+	+	-	-	-	-	-	-	-	-	-	-	-	-
114	*Diospyrus kaki* Linn.	-	-	+	+	-	-	-	-	+	-	-	-	-	-
115	*Diospyrus lotus* Linn.	-	-	-	+	-	-	-	-	+	-	-	-	-	-
116	*Duchesnia indica* forsk.	+	-	-	-	-	-	-	+	+	-	-	-	-	-
117	*Eclipta alba* Hassk.	+	+	-	-	-	-	-	-	-	-	-	-	-	-
118	*Eichornia crassipe* (Mart.) Solms	-	-	-	-	-	+	-	+	-	-	-	-	-	-
119	*Eragrostis japonica* (Thunb.) Trin.	-	+	-	-	-	-	-	-	-	-	-	-	-	-
120	*Eremostachys thyrsiflora* Bunge.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
121	*Eriobotrya japonica* (Thumb.) Lindl.	-	-	-	+	-	-	-	-	-	-	-	-	-	-
122	*Eruca sativa* Mill.	+	+	-	-	-	-	+	+	-	+	-	-	-	-
123	*Euphorbia granulata* L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
124	*Euphorbia helioscopia* Linn.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
125	*Euphorbia hirta* L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
126	*Euphorbia prostrata* Ait.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
127	*Euphorbia wallichii* Hook. f.	+	-	-	-	-	+	-	+	-	-	-	-	-	-
128	*Ficus bengalensis* Linn.	+	-	+	+	-	-	-	+	-	-	+	-	-	-
129	*Ficus carica* Linn.	+	-	+	+	-	-	-	+	+	-	+	-	-	-
130	*Ficus elastica* Roxb.	-	-	+	+	-	-	-	-	-	-	+	-	-	-
131	*Ficus palmata* Forssk.	+	-	+	+	-	-	-	+	+	-	+	-	-	+
132	*Ficus racemosa* Linn.	+	-	+	+	-	-	-	-	-	-	+	-	-	-

133	*Ficus religiosa* Linn.	+	-	+	+	-	-	-	-	+	-	+	-	-	-
134	*Fimbristylis squarrosa* Vahl.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
135	*Foeniculum vulgare* Mill.	+	-	-	-	-	-	+	+	-	+	-	-	-	-
136	*Fragaria vesica* Lindl.	-	-	-	-	-	-	+	-	+	-	-	-	-	-
137	*Fumaria indica* (Haussk.)	+	+	-	-	-	-	+	-	-	-	-	-	-	-
138	*Galium aparine* Linn.	+	+	-	-	-	-	+	-	-	-	-	-	-	-
139	*Galium elegans* Wall.	+	+	-	-	-	-	+	-	-	-	-	-	-	-
140	*Geranium rotundifolium* Linn.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
141	*Geranium wallichianum* D. Don.	+	-	-	-	-	-	-	-	-	-	-	-	-	-
142	*Gerardiana palmata* (Forssk.) Gaud.	+	-	-	-	-	-	-	-	-	-	-	-	-	-
143	*Gerbera gossypina* (Royle) Beauv.	-	-	-	-	-	-	+	-	-	-	-	-	-	-
144	*Geum elatum* L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
145	*Gnaphalium hypoleucum* DC.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
146	*Grewia optiva* Drum. Ex Burret.	+	-	+	-	-	-	-	+	-	-	+	-	-	-
147	*Hedra helix* L.	+	+	+	-	+	-	+	-	-	-	-	-	-	-
148	*Hedra nepalensis* K. Koch.	+	-	-	-	+	-	+	-	-	-	-	-	-	-
149	*Heliotrophium ophioglossum Stocks ex Boiss.*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
150	*Heliotropium strigosum Willd.*	+	-	-	-	-	-	-	-	-	-	-	-	-	-
151	*Hibiscus esculentus L.*	-	-	-	-	-	-	-	+	-	-	-	-	-	-
152	*Hibiscus rosa chinensis Linn.*	+	-	-	-	-	-	-	+	-	-	-	-	-	-
153	*Hordeum vulgare L.*	-	-	-	-	+	-	+	-	-	-	-	-	-	-
154	*Hypericum perforatum L.*	+	-	-	-	+	-	+	+	-	-	-	-	-	-
155	*Imaptiens balsiminea Linn.*	-	-	-	-	-	-	-	+	-	-	-	-	-	-
156	*Impatiens edgeworthii Hk. F.*	-	-	-	-	-	-	-	+	-	-	-	-	-	-
15	*Impatiens gigantea Egew.*	+	-	-	-	-	-	-	+	-	-	-	-	-	-

7															
158	*Impatiens parviflora DC.*	+	-	-	-	-	-	-	+	-	-	-	-	-	-
159	*Imperata cylindrica (L.) Raeuschel*	-	+	+	-	-	-	-	+	-	-	-	-	-	-
160	*Indigofera heterantha Wall.*	+	-	-	-	+	-	+	+	-	-	-	-	-	-
161	*Inula grantioides Boiss.*	-	-	-	-	-	-	-	+	-	-	-	-	-	-
162	*Ipomea palmata Forssk.*	-	+	-	-	-	-	-	+	-	-	-	-	-	-
163	*Ipomea purpura (Linn.) Roxb.*	+	-	-	-	-	-	-	+	-	-	-	-	-	-
164	*Jasminum grandiflorum L.*	-	-	-	-	-	+	-	+	-	-	-	-	-	-
165	*Jasminum multiflorum L.*	+	-	-	-	-	+	-	+	-	-	-	-	-	-
166	*Juglan regia L.*	-	-	+	+	-	-	+	-	+	-	+	-	+	-
167	*Lathyrus aphaca Linn.*	-	+	-	-	+	-	-	+	-	-	-	-	-	-
168	*Lathyrus odoratus Linn.*	-	+	-	-	+	+	-	+	-	-	-	-	-	-
169	*Lathyrus sativa Linn.*	-	+	-	-	+	-	-	+	-	-	-	-	-	-
170	*Lepidium sativum Linn.*	+	+	-	-	+	-	+	+	-	+	-	-	-	-
171	*Lespedeza juncea (Linn.F.) Pers.*	+	+	-	-	-	-	+	-	-	-	-	-	-	-
172	*Lespedeza juncea (Linn.) Pers.*	+	+	-	-	-	-	-	-	-	-	-	-	-	-
173	*Leucas urticifolia (Vahl.) R.Br. ex Sm.*	+	-	-	-	-	-	-	+	-	-	-	-	-	-
174	*Linum usittisimum L.*	+	-	-	-	+	+	+	+	-	+	-	-	-	-
175	*Luffa acutangula (Linn.) Roxb.*	-	-	-	-	+	+	-	+	-	-	-	-	-	-
176	*Luffa aegyptiaca Mill.*	-	-	-	-	+	+	-	+	-	-	-	-	-	-
177	*Luffa cylindrica (Linn.) Roem.*	-	-	-	-	+	+	-	+	-	-	-	-	-	-
178	*Lycopersicum esculentum Millers*	-	-	-	-	+	+	-	+	-	+	-	-	-	-
179	*Malus pumila Mill.*	-	-	+	+	-	-	-	+	+	-	-	-	-	-
180	*Malva neglecta Wallr.*	-	-	-	-	-	-	-	+	-	-	-	-	-	-
181	*Malvestrum coromandelianum (Linn)*	-	-	-	-	-	-	-	-	-	-	-	-	-	-

	Garoke.														
182	*Marsilia qudrifolia L.*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
183	*Medicago minima (Linn.) Grufb*	+	+	-	-	+	-	+	-	-	-	-	-	-	-
184	*Medicago sativa Linn.*	+	+	-	-	+	-	-	-	-	-	-	-	-	-
185	*Megacodon stylophorus (C. B. Clarke)*	+	-	-	-	-	-	+	-	-	-	-	-	-	-
186	*Melia azadarichta Linn.*	+	-	+	+	-	-	-	+	-	-	+	-	+	-
187	*Melilotus alba Des.*	+	+	-	-	-	-	-	-	-	-	-	-	-	-
188	*Mentha arvensis L.*	+	-	-	-	-	-	+	+	-	+	-	-	-	-
189	*Mentha longifolia (L.) Hudson.*	+	-	-	-	-	-	+	+	-	+	-	-	-	-
190	*Mentha piperata Linn.*	+	-	-	-	-	-	+	+	-	+	-	-	-	-
191	*Mentha viridis Linn.*	+	-	-	-	-	-	+	+	-	+	-	-	-	-
192	*Micromaria biflora (Ham.) Benth.*	-	+	-	-	-	-	-	-	-	-	-	-	-	-
193	*Momordica charantia Linn.*	+	-	-	-	+	-	-	-	-	-	-	-	-	-
194	*Monotheca bauxifolia (Fale) Dcne ex. Engler*	+	-	-	-	-	-	-	+	-	-	-	+	-	-
195	*Morchella esculenta Prs ex. Fr.*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
196	*Morus alba Linn.*	-	-	+	+	-	-	+	+	+	-	+	-	-	-
197	*Morus laevigata Wall.*	-	-	+	+	-	-	-	+	+	-	+	-	-	-
198	*Morus nigra L.*	+	-	+	+	-	-	-	-	+	-	+	-	-	-
199	*Myrtus communis Linn.*	+	-	+	+	-	-	-	-	-	-	-	-	-	-
200	*Narcisus poeticus Linn.*	+	-	-	-	-	+	-	+	-	-	-	-	-	-
201	*Coronopus didymus L. Smith,*	+	+	-	-	-	-	-	-	-	-	-	-	-	-
202	*Nasturtium officinalis Linn.*	+	-	-	-	+	+	-	+	-	-	-	-	-	-
203	*Nepeta clarkei Hook.f.*	+	-	-	-	-	-	-	-	-	-	-	-	-	-
204	*Nepeta erecta (Benth.) Benth.*	+	-	-	-	-	-	-	-	-	-	-	-	-	-
205	*Olea ferruginea Royle.*	+	-	+	+	-	+	-	-	-	-	+	-	-	+

206	*Origanum vulgare Linn.*	+	-	-	-	-	-	-	+	-	-	-	-	-	-
207	*Oryza sativa L.*	-	+	-	-	-	-	-	-	-	-	-	-	-	-
208	*Ocimum basilicum Linn.*	+	+	-	-	-	-	-	+	-	-	-	-	-	+
209	*Oxalis corniculata Linn.*	-	+	-	-	+	-	-	-	-	-	-	-	-	-
210	*Oxalis corymbosa DC.*	-	+	-	-	+	-	-	-	-	-	-	-	-	-
211	*Oxalis pescapre Linn.*	-	-	-	-	+	-	-	-	-	-	-	-	-	-
212	*Paeonia emodi Wall. Ex Hkf.*	+	-	-	-	-	-	+	+	-	-	-	-	-	-
213	*Papaver somniferum Linn.*	-	-	-	-	-	-	-	+	-	-	-	-	-	-
214	*Pennisetum orientale Rich.*	-	+	-	-	-	-	-	-	-	-	-	-	-	-
215	*Phlomis bracteosa Royle*	+	-	-	-	-	-	-	-	-	-	-	-	-	-
216	*Picea smithiana (Wall.) Boiss.*	+	-	+	+	-	-	-	-	-	-	+	-	+	-
217	*Pimpinella diversifolia DC.*	+	-	-	-	-	-	-	+	-	-	-	-	-	-
218	*Pinus gerardiana Wall. ex Lamb.*	-	-	+	+	-	-	-	-	-	-	+	-	+	-
219	*Pinus roxburghii Sargent.*	-	-	+	+	-	-	+	-	-	-	+	-	+	-
220	*Pinus wallichiana A. B. Jackson.*	-	-	+	+	-	-	-	-	-	-	+	-	+	-
221	*Pisticia integrima Stew ex. Brandis*	+	-	+	+	+	+	+	+	-	-	-	-	+	-
222	*Pisum sativum Linn.*	-	-	-	-	+	+	-	+	-	-	-	-	-	-
223	*Plantigo lanceolata Linn.*	-	+	-	-	-	-	-	-	-	-	-	-	-	-
224	*Plantigo major Linn.*	-	+	-	-	-	-	-	-	-	-	-	-	-	-
225	*Plantigo ovata Forssk.*	+	+	-	-	-	-	-	-	-	-	-	-	-	-
226	*Platanus orientalis Linn.*	+	-	+	+	-	-	-	-	-	-	+	-	-	-
227	*Plectranthus rugosus Wall. ex Benth.*	+	-	+	-	-	-	-	+	-	-	-	+	-	-
228	*Poa annua L.*	-	+	-	-	-	-	-	-	-	-	-	-	-	-
229	*Podophylum emodi Wall.*	+	-	-	-	-	-	+	+	-	-	-	-	-	-
23	*Polygonum aviculare Linn.*	+	-	-	-	-	-	-	-	-	-	-	-	-	-

0															
231	*Polygonum barbatum Linn.*	+	-	-	-	-	-	+	-	-	-	-	-	-	-
232	*Polygonum glabrum Willd.*	+	-	-	-	-	-	-	-	-	-	-	-	-	-
233	*Polygonum plebejum R. Br.*	+	-	-	-	-	-	-	-	-	-	-	-	-	-
234	*Portulaca oleracea L.*	+	+	-	-	+	+	-	-	-	-	-	-	-	-
235	*Prunella vulgaris Linn.*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
236	*Prunus armeniaca Linn.*	-	-	+	+	-	-	-	+	-	+	-	-	-	-
237	*Prunus bukharensis Royle*	-	-	+	+	-	-	-	+	-	+	-	-	-	-
238	*Prunus persica (Linn.) Batsh*	+	-	+	+	-	-	-	+	-	-	-	-	-	-
239	*Psidium guajava L.*	-	-	+	+	-	-	-	+	+	-	-	-	-	-
240	*Pteridium eqilinium L.*	-	-	-	-	-	+	-	-	-	-	-	-	-	-
241	*Pteris vitata L.*	-	-	-	-	-	+	-	-	-	-	-	-	-	-
242	*Punica granatum L.*	-	-	+	-	-	+	+	+	+	+	-	-	-	-
243	*Pyrus communis Linn.*	-	-	+	+	-	-	-	+	+	-	+	-	-	-
244	*Pyrus pashia Ham.*	-	-	+	+	-	-	-	+	+	-	+	-	-	-
245	*Quercus baloot Griff.,*	-	-	+	+	-	-	-	+	-	-	+	-	+	-
246	*Quercus dilatata Lindl.*	-	-	+	+	-	-	-	+	-	-	+	-	+	-
247	*Quercus incana Roxb.*	-	-	+	+	-	-	-	+	-	-	+	-	+	-
248	*Quercus lanata Smith,*	-	-	+	+	-	-	-	+	-	-	+	-	+	-
249	*Quercus semicarfifolia Sm.*	-	-	+	+	-	-	-	+	-	-	+	-	+	-
250	*Ranunculus aquitalis L.*	-	-	-	-	-	-	-	+	-	-	-	-	-	-
251	*Ranunculus murricatus Linn.*	-	-	-	-	-	-	-	+	-	-	-	-	-	-
252	*Robinia pseudocacia Linn.*	+	-	+	+	-	+	-	+	-	-	-	-	-	-
253	*Rosa indica L.*	-	-	-	-	-	+	-	+	-	-	-	+	-	-
254	*Rosa macrophylla Lindl.*	-	-	-	-	-	+	-	+	-	-	-	+	-	-

255	*Rosa webbiana Wallich ex Royle,*	-	-	-	-	-	+	-	+	-	-	-	+	-	-
256	*Rubia cordifolia Linn.*	+	-	-	-	-	+	-	+	-	-	-	+	-	-
257	*Rubus ellipticus Smith.*	+	-	-	-	-	+	-	+	-	-	-	+	-	-
258	*Rubus foliolosus D. Don*	-	-	-	-	-	+	-	+	-	-	-	+	-	-
259	*Rubus fruticosus L.*	-	-	-	-	-	+	-	+	-	-	-	+	-	-
260	*Rubus sanctus Schreb.*	+	-	-	-	-	+	-	+	-	-	-	+	-	-
261	*Rumex aviculare L.*	-	+	-	-	-	-	-	-	-	-	-	-	-	-
262	*Rumex dentatus Linn.*	-	+	-	-	+	+	+	-	-	-	-	-	-	-
263	*Rumex hastatus D. Don..*	+	+	-	-	-	-	-	-	-	-	-	+	-	-
264	*Rumex naphalensis Sprengel*	+	+	-	-	+	+	-	-	-	-	-	-	-	-
265	*Rumex persicaria L.*	+	+	-	-	-	-	-	-	-	-	-	-	-	-
266	*Saccharum munja Roxb.*	-	-	-	-	-	-	-	-	-	-	-	+	-	-
267	*Saccharum spontanuum L.*	-	-	-	-	-	-	-	-	-	-	-	+	-	-
268	*Saliginella spp.*	-	-	-	-	-	+	-	-	-	-	-	-	-	-
269	*Salix babylonica L.*	-	-	+	+	-	-	-	+	-	-	+	-	+	-
270	*Salix tetrasperma Roxb. Pl. Corom.*	-	-	+	+	-	-	-	+	-	-	+	-	+	-
271	*Salvia lanata Roxb*	+	-	-	-	-	-	-	+	-	-	-	-	-	-
272	*Salvia moorcroftiana Wall.*	+	-	-	-	-	-	-	+	-	-	-	-	-	-
273	*Salvia nubicola Wall.*	+	-	-	-	-	-	-	+	-	-	-	-	-	-
274	*Sarcococca saligna (D.Don) Muell.*	+	-	+	-	-	-	-	+	-	-	-	-	-	-
275	*Sauromatum venosum (Aiton) Kunth*	+	-	-	-	-	-	-	-	-	-	-	-	-	-
276	*Saussoria albescens (DC) Sch. Bip.*	-	-	-	-	-	-	-	+	-	-	-	-	-	-
277	*Segeretia thea (L.) Brongn.*	+	-	+	-	-	-	-	+	-	-	-	+	-	-
278	*Senecio chrysanthemoides DC.*	+	-	-	-	-	-	-	-	-	-	-	-	-	-
27	*Seriphidium stanosephalum*	+	-	-	-	-	-	-	+	-	-	-	-	-	-

9															
280	*Silene conoide Linn.*	+	+	-	-	-	-	-	-	-	-	-	-	-	-
281	*Silene vulgaris (Moench) Garcke*	+	+	-	-	-	-	-	-	-	-	-	-	-	-
282	*Sisymbrium irio Linn.*	+	+	-	-	-	-	-	+	-	-	-	-	-	-
283	*Solanum melongena Linn.*	-	+	-	-	+	+	-	+	-	-	-	-	-	-
284	*Solanum nigrum* L.	+	+	-	-	+	+	+	+	+	-	-	-	-	-
285	*Solanum pseudocapsicum* L.	+	-	-	-	-	+	-	+	+	-	-	-	-	-
286	*Solanum surretensis* Burm. f.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
287	*Solanum villosum* Mill.	+	-	-	-	-	+	-	+	-	-	-	-	-	-
288	*Sonchus arvensis* (DC) Kirp.	-	+	-	-	-	-	-	-	-	-	-	-	-	-
289	*Sorghum nephalensis* (L.) Hill.	-	+	-	-	-	-	-	-	-	-	-	+	-	-
290	*Sorghum nitidum* (Vahl) Pers.,	-	+	-	-	-	-	-	-	-	-	-	+	-	-
291	*Spiraea Lindleyana* Wall.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
292	*Stachys emodi* Hedge (S. I. Ali & Y. J. Nasir)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
293	*Stachys seriaca* Wall. ex Benth.	+	-	-	-	-	-	-	-	-	-	-	-	-	-
294	*Stellaria media* (L.) Vill.	-	+	-	-	-	-	-	-	-	-	-	-	-	-
295	*Tagetes erecta* Linn.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
296	*Taraxicum officinalis* Weber	+	+	-	-	+	+	-	+	-	-	-	-	-	-
297	*Thalictrum pendunculatum* Edgew.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
298	*Themeda anathera* (Nees ex Steud.) Hack.	-	+	-	-	-	-	-	-	-	-	-	-	-	-
299	*Thymus serphylum* Benth.	+	-	+	-	-	-	-	+	-	-	-	-	-	-
300	*Trichodesma indica* (L.) R. Br.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
301	*Trifolium alexandrium* Linn.	-	+	-	-	+	+	+	+	-	-	-	-	-	-
302	*Trifolium repense* Linn.	-	+	-	-	+	+	+	+	-	-	-	-	-	-
30	*Trigonella foenum-graecum*	+	-	-	-	+	+	-	+	-	-	-	-	-	-

3	Linn.														
304	*Triticum aestivum* L.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
305	*Urtica dioica* Linn.	+	-	-	-	-	-	-	-	-	-	-	-	-	-
306	*Urtica hyperborea* L.	+	-	-	-	-	-	-	-	-	-	-	-	-	-
307	*Valeriana* spp.	+	-	-	-	-	-	-	-	-	-	-	-	-	-
308	*Verbascum thapsis* L.	+	-	-	-	-	-	-	+	-	-	-	-	-	-
309	*Vibernum grandiflorum* Wall. Ex DC.	+	-	+	-	-	-	-	+	-	-	-	-	-	-
310	*Vigna vexillata* (L.) A.Rich.	-	+	-	-	-	-	-	+	-	-	-	-	-	-
311	*Viola biflora* L.	-	+	-	-	-	-	-	+	-	-	-	-	-	-
312	*Viola serpens* Wall. Ex Roxb.	+	-	-	-	-	-	+	+	-	-	-	-	-	-
313	*Vicia faba* Linn.	-	+	-	-	+	+	-	+	-	-	-	-	-	-
314	*Vicia hirsuta* (L.) S. F. Gray	-	+	-	-	+	+	-	+	-	-	-	-	-	-
315	*Withania somnifera* L.	+	-	-	-	-	-	-	-	-	-	-	-	-	-
316	*Woodfordia fruticosa* (L.) Kurz.	-	-	+	-	-	-	-	-	-	-	-	-	-	-
317	*Xanthium strumarium* Linn	-	-	-	-	-	-	-	-	-	-	-	-	-	-
318	*Zanthoxylum armatum* DC.	+	-	+	-	-	-	+	+	-	+	-	+	-	-
319	*Zea mays* L.	-	+	-	-	-	-	-	+	-	-	-	-	-	-
Total		164	87	59	47	45	62	63	180	22	18	34	25	19	8

Key Note: MP = Medicinal Plants, FP = Fodder Plants, FW = Fual Wood, TW = Timber Wood, Vg = Vegetable, PH = Pot Herbs, VP = Veterinary Plants, HB = Honey bee Plants, FYP = Fruit yielding Plants, SC =Spice and Condiments, AA = Agricultural Appliances, FF = Field Fencing Plants, FP = Furniture Plants, ERP = Evil Repellent Plants.



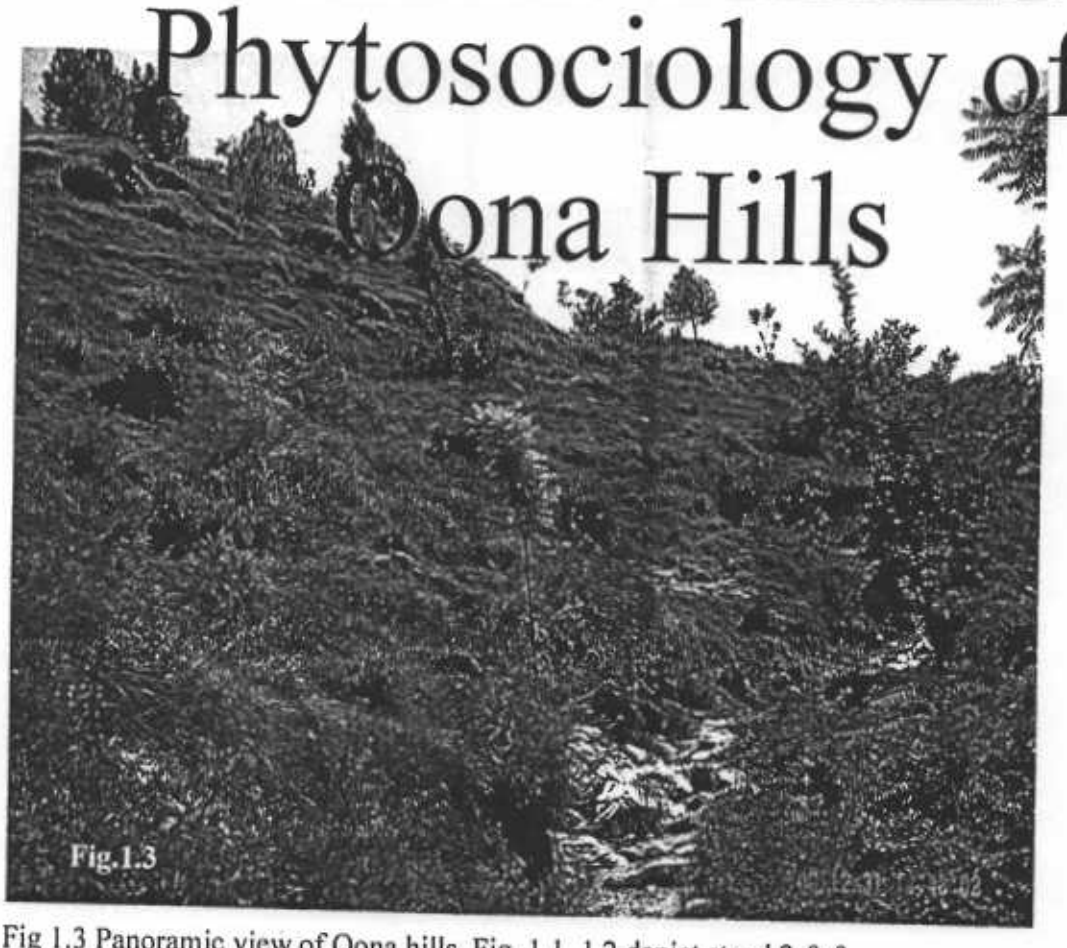


Fig 1.3 Panoramic view of Oona hills, Fig. 1.1, 1.2 depict stand 2 & 3.

The study was carried out in three consecutive years (2007-2010) in three seasons, i.e. spring season, summer season and winter. The research area was divided into five sites, namely, Oona Hills, Gumrush Hills, Dhanakol Hills, Bakht Banda Hills and Dhali Hills of these vegetation of Oona hills is reported and discussed below..

Oona Hills

Oona Hills are located 34^0 50′ 0 N, 72^0 46′ 0 E on south of Chakesar valley. It is a series of western extremities of great Himalayan range (Fig. 2). Its altitude ranges from 1124m – 2030m. Important sites that were thoroughly investigated were Dhabb, Meera and Ramjany. Ramjany is the highest peak with 2030m altitude. A number of settlements were scattered in the hills. In fact, these patches of settlements were badly disturbed the vegetation in their vicinity. Locals are indigenous and lead very miserable life. They depend on small farmlands, only maize, wheat and some vegetables are cultivated. Cattle rearing the major source of livelihood.

According to the locals, there were small springs which used to fulfill their water demands. Now, these all springs had dried and they face severe shortage of water resources and they are relying on the stored rain water in forms of small ponds. It had some archeological sites and remained a sacred place of Hinduism.

The living style is very simple and locals preferred synthetic drugs instead of herbal medication. They know very little about local medicinal plants and their uses. The area had rich diversity of plants in the past and some remnant trees like *Quercus*, pines and chestnut indicate the past flora of the area. The graveyard is best ruminant of past vegetation and depicts a clear picture of the past vegetation. Medicinally important and highly nutritious herbs were found on high altitudes.

1. Spring Aspect

Spring season starts from April to June. The site was divided into five stands on the basis of physiognomy and topography. Each stand was selected at 150m distance. The different plant communities established are discussed below.

1. *Berberis – Dichanthium – Debregesia* community (BDD)

This community was established at (Dhabb) foot hill of the Oona at 1124m altitude. The dominant species were *Berberis lyceum* (IV=189) *Dichanthium annulatum* (IV=170) and *Debregesia salisifolia* (IV=100). Other important species were *Quercus incana* (84.1), *Pinus wallichiana* (IV=36.3), *Ficus palmate* (IV=33.5), *Ailanthus altissima* (IV=32.1), *Melia azadarichta* (IV=32.1) in tree layer and

Artemisia vulgare (IV=30.7) in ground layer. This community was supported by 20 plant species including 9 species of herbs, 3 species of shrubs and 8 species of trees (Table 1.1.1).

Environmental data showed that air temperature was 88.9 F^0, relative humidity 58.7 %, wind speed was 5 mph in 331^0. Par light was 714 µM/mΛ2S, leaf wetness was 14, indicated moist conditions of the stand and solar radiation was 938 Wat / m^2(Table 1.9).

Therophytes and microphanerophytes dominated the community with 30 % and 25 % contribution. Leaf form spectrum showed that nanophyll and microphylous leaf sizes were dominant. Thus, the community is thero-nanophylous showing harsh habitat conditions (Table 1.1).

2. *Sorghum- Sarcococca-Plectranthus* Community (SSP)

This stand covered Meragai at altitude of 1274m with slope of 20^0. The habitat is open, sunny with soil temperature 31.8 C^0. It was western aspect of Oona hill. A total of 12 species were present in the community. Herbs contributed 6 species, shrubs 5 species and tree layer had only *Pinus wallichiana.* The dominant species with importance values were *Sorghum nephalensis* (IV=130.4), *Sarcococca saligna* (IV=130.2), *Plectranthus rugosus* (IV=117.7), *Cannabis sativa* (IV=73.8) and *Trifolium repens* (IV=41.3).

Table 1.9 show the air temperature was 88.6 F^0, photosynthetically active radiation (PAR) was 710 µM/mΛ2S, followed by leaf wetness which had 1 value. It indicated dried habitat condition. Solar radiation was recorded 1232 Wat/m^2 and relative humidity was 57.4 %. Wind was blowing with 283^0 with 2 mph speed.

The community had mixed life form of therophytes, hemicryptophytes and cryptophyes while leaf form spectrum showed that nanophyll dominated the community (Table 1.1.2).

3. *Plectranthus- Quercus - Pinus* Community (PQP)

This community developed at altitude of 1399m with slightly moist habitat conditions on the eastern face of the slope with 60^0. The community had 23.5 C^0 soil temperature. The dominant were *Plectranthus rugosus* (IV= 170.1), *Quercus dilatata* (IV= 161.1), *Pinus wallichiana* (IV= 138.9), *Berberis lyceum* (IV= 94.8), *Desmostachya bipinnata* (IV= 75.5) and *Saccharum munja* (IV= 54.7). The community consisted of 12 species comprised of 7 herbs, 3 shrubs and 2 trees.

Air temperature was 87.4 F^0 and relative humidity was 57.4 % in atmosphere. PAR light was 647 µM/mΛ2S and leaf wetness was 13. This value described moisture content in the vicinity of plants. Total solar radiation prevailing in the stand was 1400 W/m^2. Wind speed was 8mph speed at 59^0 in east direction (Table 1.9).

Hemicryptophytes and therophytes dominated the life form spectrum. Leaf form spectrum consisted microphyll and leptophyll (Table 1.1.3).

4. *Ailanthus -Cannabis - Ficus* Community (ACF)

Stand four which is properly called Oona at altitude of 1400m had ACF community comprised of 5 herbs, 4 shrubs and 2 trees. It was present north aspect of with moist habitat. Deforestation and overgrazing was high at this stand. The soil was blackish due to organic matter and had 24 C^0 temperature. The dominants were were *Ailanthus altissima* (IV= 167.6), *Cannabis sativa* (IV= 134.6), *Ficus palmate* (IV= 132.4), *Plectranthus rugosus* (IV= 110.3), *Indigofera hetrantha* (IV= 130.4), *Cyanodon dactylon* (IV= 101.6).

The vegetation was supported by nature at 87.3 F^0, 720 µM/mΛ2S PAR light, 14 value of leaf wetness, 1450 W/m^2 solar radiation. Air had a speed of 5 mph in north direction with 340^0. 52.1 % humidity was present in the air (Table 1.9).

Chameophytes and therophytes were in highest percentage in life form spectrum and nanophyll and leptophyll were the dominant leaf form (Table 1.1.4).

5. *Pinus – Indigofera – Cannabis* Community (PIC)

Stand five at Ramjany was the hill top with in altitude of 1675m. The leading dominant of the community were *Pinus wallichiana* (158.2), *Indigofera hetrantha* (119), *Cannabis sativa* (118), *Plectranthus rugosus* (106.5), *Cyanodon dactylon* (84.2), *Ailanthus altissima* (75.4).

They were 19 species which included 10 species of herbs, 6 species of shrubs and 3 species of trees. The community was open and soil color is black with 45^0 slope. The habitat condition was moist and soil temperature was 22 C^0. This community had at temperature of 85.6F^0, PAR light 630 µM/mΛ2S, 13 LW and solar radiation 1230 W/m^2. Humidity was 44.1 % in atmosphere with gentle breeze of 10mph speed at 87^0 (Table 1.9).

Generally vegetation height was 30m and community coverage was 97 %. Tree coverage was 5 %, shrubs 52 % and herbs covered 47 %. Biological spectrum indicated that hemicryptophytes and chameophytes were the most prevailing classes

of life form and nanophyll and microphyll were dominant in leaf form spectrum (Table 1.1.5).

Summer aspect

Summer season started at mid of June to the end of September in their area. Generally; most of the plants grew in this season. The communities established are as follow.

1. ***Thymus – Zanthoxylum – Ailanthus* community (TZA)**

Thymus – Zanthoxylum – Ailanthus community established at Dhabb stand. The site was the same as that of spring aspect. The plant species dominating the stand were *Thymus serphylum* (IV= 160.6), *Zanthoxylum armatum* (IV= 139.4) and *Ailanthus altissima* (IV= 116.4). A total of 34 plant species were recorded in the stand which consisted of 27 species of herbs, 2 species of shrubs and 5 species were trees. The diversity of plants was high in all stands. The high numbers of plants were recorded for *Stachys emodi, Oxalis corniculata, Cannabis sativa* and *Artemisia japonica.* The shrubs like *Thymus serphylum* and *Zanthoxylum armatum* dominated the stand. The stand was close to the water channel and biotic interference in the form of grazing and deforestation was high. Trees of other plants were cut off for clearing the land.

Biological spectrum showed that therophytic (50 %) and hemicryptophytes (17.6 %) had the highest proportion in biological spectrum while leaf form spectrum was dominated by micro- nanophyllous leaf size classes (Table 1. 2.1).

2. ***Plectranthus – Cynodon – Berberis* Community (PCB)**

The habitat was dry and open stand. It occupied west aspect of the hill. A total of 28 plant species were identified in the stand. The most dominant species were *Plectranthus rogugosus* (IV= 124.2), *Cynodon dactylon* (IV= 107.7) and *Berberis lyceum* (IV= 54.4). Other important species included *Segeretia thea* (IV= 50.7), *Saccharum spontanum* (IV= 31.5) and *Lespedeza juncea* (IV= 27.8). Cryptophytes and therophytes were most prevailed life form spectrum with 64.3 % and 28.6 % respectively. Nanophyll (46.4 %) and microphyll (32.1 %) were the dominant leaf form classes (Table 1. 2.2).

3. ***Quercus – Pinus - Thymus* Community (QPT)**

This community consisted of 23 species in which herbs and shrubs had 10 species each. Tree layer had only three species. The dominant species were *Quercus incana* (IV= 145.5), *Pinus wallichiana* (IV= 121) and *Thymus serphylum* (IV= 104.8).

The other important species were *Poa annua* (IV= 98.9), *Cynodon dactylon* (IV= 76.6), *Sarcococa saligna* (IV= 51.6) and *Berberis lyceum* (IV= 46.3). Biological spectrum showed therophytic vegetation dominated with 39.1 %, followed by nanophanerophytes and microphanerophytes with 17.4 % each class. In the leaf form classes microphyll (43.5 %) and nanophyll (26.1 %) dominated the stand (Table 1. 2. 3).

4. ***Thymus – Juglan – Indigofera* Community (TJI)**

This community established at altitude of 1540 m with a total of 20 plant species. It included 9 herb, 3 shrub and 8 tree species. *Thymus serphylum* (IV= 138), *Juglan regia* (IV= 93) and *Indigofera hetrantha* (IV= 87.4) were the dominants while *Berberis lyceum* (IV= 74.6), *Cannabis sativa* (IV= 59.2), *Ficus palmate* (IV= 53.5) and *Polygonum plebejum* (IV= 53) were co-dominant. Nanophyll (50 %) and microphyll (30 %) were dominant in leaf form spectrum while therophytes, nanophanerophytes and mesophanerophytes were equally dominant life form classes (Table 1. 2. 4).

5. ***Indigofera – Berberis – Salix* Community (IBS)**

This stand was present on the top hill at Ramjany. It had 33 species in which 23 were herbs, 4 shrubs and 6 were tress species. This community was established by *Indigofera hetrantha* (IV= 143.8), *Berberis lyceum* (IV= 96.9) and *Salix tetrasperma* (IV= 91.2) as dominants. Other important species were *Dichanthium annulatum* (IV= 67.8), *Pinus hepalensis* (IV= 60.4), *Debregetia salisifolia* (IV= 51.6) and *Cynodon dactylon.* This stand was homogeneous covering almost peak of the Oona hill. Nanophyll and microphyll were dominant in leaf size classes while therophytes dominated life spectrum (Table 1. 2.5).

Winter Aspect

Winter season is long lasting from the end of September the end of March. It is a dormant season with very low plant diversity. The vegetation of foot hill had high species richness compared to the other stands. Various established communities are as follows.

1. ***Saccharum – Debregetia – Berberis* Community (SDB)**

This community at foot hill was dominated by *Saccharum munja* (IV= 197.7), *Debregetia salisifolia* (IV= 149.1) and *Berberis lyceum* (IV= 103.6). *Ailanthus altissima* (IV= 103), *Morus alba* (IV= 55.6), *Diospyrus kaki* (IV= 46.3) and *Cynodon*

dactylon (IV= 41.1) were other important species. The community is supported by 14 plant species included herbs, 4 shrubs and 6 trees. The annual plants reduced in favor of trees and shrubs. The cryptophytes, chameophytes and phanerophytes contributed more than other classes. Microphyll was dominant leaf form class with highest proportion of 71 %. The deciduous became leafless. Only leptophyll and microphyll of some plants persisted (Table 1. 3. 1).

2. ***Pinus – Saccharum – Plectranthus Community* (PSP)**

This stand consisted of 7 plants species in which 2 were herbs, 3 were shrubs and 2 were trees dominance of *Pinus roxburghii* (IV= 203.4), *Saccharum munja* (IV= 170.1) and *Plectranthus rogusus* (IV= 162.3). Associated species included *Cynodon dactylon* (IV= 129.9), *Berberis lyceum* (IV= 104.) and *Pyrus pashia* (IV= 96.6). The community mostly had therophytes. The phanerophytes also reduced due to ruthless cutting. Microphyll and leptophyll were the leaf forms that existed. These forms were suitable to underpass the harsh environment (Table 1. 3. 2).

3. ***Plectranthus – Origanum – Quercus* Community (POQ)**

This open stand is exposed to wind and had only 6 species. The herbs, shrubs and trees, each shared two species. *Plectranthus rogusus* (IV= 276.6), *Origanum vulgare* (IV= 250.7) and *Quercus dilatata* (IV= 179) were the dominanats. The associated species included *Micromaria biflora* (IV= 49.3) and *Sarcococa saligna* (IV= 23.4). Chameophytes and macro phanerophytes were the major classes in life form spectrum while leptophyll and microphyll were represented the leaf form classes (Table 1. 3. 3).

4. ***Plectranthus – Dactylis – Ailanthus* Community (PDA)**

This poorly established community, had 5 plant species, in which 2 were herbs, one shrub and 2 species were in tree layer. The dominant and associated species with respect to importance values were *Plectranthus rogusus, Dactylis , Ailanthus altissima* and *Juglan regia* in tree layer and *Tagetes erecta* in herbaceous layer. The dominant life form class was macrophanerophytes and nanophyll was the major leaf form class (Table 1. 3. 4).

5. ***Sorghum – Berberis – Plectranthus* Community (SBP)**

This community was established on top of the hill and supported by 10 species in which 4 were herbs, 2 were shrubs and 4 species were trees. The dominants were *Sorghum hapalensis* (IV= 185.2), *Berberis lyceum* (IV= 168.2) and *Plectranthus rogosus* (IV= 132.3). Other associated species were *Ailanthus altissima* (IV= 109.7)

followed by *Olea ferruginea* (IV= 85), *Pinus wallichiana* (IV= 67.7) and *Tagetes erecta* (IV= 51.2). Mesophanerophyte was the dominant life form. Microphyll was dominant leaf form class (Table 1. 3. 5).

The plant resources of the valley comprised of 319 plant species. The habitat, environmental factors and vegetation types determined structure of communities. Communities are helpful in identification, naming and classification of vegetation types. Communities structures analyze, interpret the plants at different exposure and provide first hand information about vegetation and are basis for prediction of future changes (Muller-Dumbois & Ellenberg, 1974). Izco (2008) pointed out that phytosociological data provide good materials of ecological, chronological and taxonomic information. Biotic and abiotic factors are related to each other and changes in anyone factor might cause a change in associated components. Brinkmann *et al.,* (2009) analyzed the vegetation response to environmental conditions of open woodlands along an altitudinal and a grazing gradient. Anthropogenic activities, overgrazing, habitat destruction, land sliding, soil erosion, unplanned settlements and poverty are factors that influenced vegetation structure. The site one Oona hills, lied between 1125 – 1675 m high above sea level.

The vegetation of Oona hill was analyzed in three seasons, i.e. spring, Summer and winter. Five plant communities were identified in each season. Generally, the site had moist deciduous temperate forests at foot hills, scrubby forests in mid hill and dry deciduous forests in top hill. In the investigated area, perennial and woody species remained almost the same. Only annual and some perennial species changed from one season to other that changed the composition of communities (Malik, 2005). The different communities established in different seasons reflected various remnants as identified by Champion *et al.* (1995); Beg and Khan (1984). It appeared that *Berberis – Dichanthium – Debregesia* might be the remnant of the original moist temperate forest. The associated species of this community were *Morus alba, Morus nigra, Berberis lyceum, Rubus fruiticosus, Sageretia thea, Ailanthus altissima* and *Melia azadarichta.* The grasses like *Sorghum nephalensis, Dichanthium annulatum, Cynodon dactylon* and *Poa annua* were the plants that had characteristic of temperate zone. The vegetation then changed to *Berberis – Dichanthium – Debregetia, Sorghum – Sarcococa – Plectranthus* and *Plectranthus – Quercus–Pinus* communities in spring season and *Thymus–Zanthoxylum–Ailanthus, Plectranthus–Cynodon–berberis* and *Quercu –Pinus – Thymus* communities in summer season. Cayuela *et al.,* (2008)

evaluated the response of herbaceous communities to previous and current environmental conditions and stated that water stress decrease alpha and beta diversity during community establishment.

Biotic disturbances are severe in the site as the local had cut down trees. Trees are now limited only to the patches where accessibility is very difficult. They used *Pinus* and *Quercus* trees for different utilities. According to Malik *et al.* (2004) locals had caused degradation of trees and hampered regeneration. The habitat conditions shift from moist to dry in stand II. Kennenni (2008) revealed different plant community types due to variation in climatic, edaphic and biotic factors. Our results revealed that soil texture was sandy loam in all the studied area with high amount of organic matter and almost have same pH while the degraded stand had low organic matter, EC, N (%), P (mg/kg) and ex. K (Table 1.4). It was known that EC values increase with altitude and ex. Na decreased. Malik *et al.*, (2001) described that chemical contents of the soil played a significant role in giving particular shape to these communities. Malik & Malik (2004) stated that soil conditions and percentage of phosphorus and equal amount of potassium in soil affected the vegetation. A similar result was shown by Parveen *et al.* (2008) that vegetation cover varied with texture and structure of the soil same was truein this case also. A very little change in air temperature was noted. Oona site had good range of PAR (photosynthetically active radiation) light and all the stands were suitable for maximum productivity by capturing solar radiation. Similarly stand II which is a disturbed habitat shifted to dry habitat and this shifting is continue in both direction i.e. upward and downward, but it is more rapid in upward direction. This had changed the habitat conditions and also climatic conditions. The communities like *Ailanthus – Cannabis – Ficus, Pinus – Indigofera – Cannabis* in spring season and *Indigofera – Berberis – Salix* in summer season shifted to *Plectranthus – Dactylis – Ailanthus* and *Sorghum – Berberis – Plectranthus* in winter aspect. It is obvious that *Cannabis sativa* and *Ailanthus altissima* are exotic species and spread with high speed to the top hill and almost had occupied and replaced the natural vegetation. These retrogressive changes in vegetation had altered the weather, edaphic characteristics. *Indigofera, Ficus, Ailanthus* and *Plectranthus* are non palatable plants. These plants utilized as fuel wood. Enright *et al.*, (2005) described vegetation of mountains, cliffs and canyons showed higher species richness and lower human impacts (from livestock grazing and wood harvesting) than did that of riparian and plains habitats. Removal of *Pinus*

wallichina, Quercus species and invasion of these species had paved the way to grassland. The following review is available to describe similar disturbed vegetation in different parts of the northern area, Malik, 2005; Hussain *et al.*,1992; Hussain & Ilahi, 1991; Sakya & Bania (1998) reported similar change in vegetation conditions in North West Himalaya in India. They described that altitude is an important in determining vegetation type. Altitudinal gradient can also alter floristic composition and community structure. In the present study, the vegetation become patchier in open canopy at high altitude and also along the ridges in even low elevation. In top hill, *Pinus – indigofera – Cannabis, Indigofera – Berberis – Salix, Sorghum – Berberis – Plectranthus* communities were developed in different seasons of the year. Overgrazing, trampling, smuggling of wood, nomad and deforestation had disturbed the natural vegetation to extensive level which had resulted removal of tree species, shrubs and some medicinal plants. This has caused fragmented vegetation on the top and graveyards.

Edaphic features

Oona hills show altitudinal and slope variations i.e. from foot hills to top of the hill. This also caused variation in vegetation structure. Habitat remained moist except stand II which was dried. The slope aspect also varied from east to west, which also affected vegetation make up. Soil texture was found to vary from loamy sand to sandy loam. Soil of the site was found to be slightly acidic ranged from pH 6.1 (Ramjany) to 6.5 (Meragai & Oona). The EC also varied from 0.07 (stand IV) to 0.31 (Stand I). The exchangeable sodium was almost similar in all stands except in stand IV which had low value. The organic matter was almost similar in all the stands except stand III that had 0.06 %. Phosphorus contents varied from 4 mg/kg (stand iii) to 12 mg/kg (stand i) while nitrogen content also varied from 0.004 % (stand iii) to 0.121 % (stand v). Potassium contents ranged from 40 mg/kg (stand iii) to 190 mg/kg (stand i). Soil erosion was high and resulted in low mineral composition of the soil (Table 1.4).

Species Richness and Diversity

Species richness was highest in summer and lowest in winter.this is obvious due to dormant cold condition during winter . It ranged from 0.371 (SSP) to 0.737 (PIC) in spring season, 0.464 (QPT) to 0.928 (TZA) in summer season and 0.013 (SDB) to 0.279 (POQ) in winter season. It seemed that species richness was also influenced by temporal variations (Table 1. 5). Normally spring and summer have

high diversity and richness of species. Similarly diversity index showed that highest value was recorded in summer stand I. It ranged from 1.8 (BDD) to 2.3 (PQP) in spring aspect, 2.2 (QPT) to 3.11 (TZA) in summer aspect and 1.0 (POQ) to 1.81 (SDB) in winter aspect. The results indicated that TZA (stand i) community in summer season had the highest diversity (Table 1. 5).

The results revealed that summer vegetation was rich in species and winter was very poor. Winter is a dormant season where by phenological and all activities remained postponed. Even people restrict to their homes. Species richness ranged 0.464 to 0.928 in summer and 0.013 to 0.279 in winter while spring season had moderate richness of 0.371 – 0.737. Jesson (2007) described that ecological traits might influence species richness in Newzaland. He suggested that regional differences in community processes can influence speciation or extinction. Local species richness also vary considerably across a landscape, suggesting that local factors may be more important than those acting at larger scale (Pausas & Austin 2001; Ohlemuller *et al.*, 2006). Changing of large habitat into smaller ones, involved reduction of space availability.

Dastagir *et al.*, (1999) stated that index of diversity and its components equitability, species maturity decreased from low altitude to high altitude. In Oona hills, the settlements are concentrated in mid hill and top hill areas. The foot hill habitat is close to rain water channel and its slopes do not favor the people to reside there. Therefore, the present results regarding diversity index are not in line with the former review. Generally, plant species diversity was high in summer aspect as it is moderate and is prolonged. The lowest diversity of species recorded in winter season because winter is severe. Index of maturity increases with increase in altitude. Highest % of maturity index was observed for stand II & IV in winter season. It was 62.9% and 78 % respectively. Equitability is related to species richness and diversity. Higher the species richness higher will be evenness and similarly diversity. In winter aspect stand III & IV had shown no even distribution and thus these stands had very low diversity.

Maturity Index

Table 1.5 depicted that highest maturity index was recorded for PDA community (78) followed by PSP (62.9), ACF (58.2) and 56.7 (POQ). The lowest index of maturity noted for BDD (27) followed by TJI (27.1).

Equitability

The equitability showed that stand I (BOD) during spring season had the lowest (0.2) followed by SSP (0.24). Summer season had the highest equitability values than other season. The highest value recorded was 0.32 (TZA). Generally winter season had the lowest equitability values than other season for Oona hills (Table 1.5).

Indices of Similarity

The communities in different seasons showed high degree of variability among themselves. *Plectranthus-Quercus-Pinus* Community (PQP) had 79 %, showed the highest degree of similarity with *Sorghum-Sarcococa-Plectranthus* Community (SSP) of 21 % in spring aspect (Table 3). In summer season, *Plectranthus–Cynodon–Berberis* Community (PCB) closely related to *Thymus–Zanthoxylum–Ailanthus* community (TZA), *Quercus–Pinus-Thymus* Community (QPT) with *Plectranthus–Cynodon–Berberis* Community (PCB) and *Thymus–Juglan–Indigofera* Community (TJI) with *Quercus–Pinus-Thymus* Community (QPT). Table 1.6 revealed that index of similarity is poor between different stands. The plants remained dormant and had very low species richness. All the stands in winter were dissimilar.

Table 1.6 revealed that different communities had shown high degree of variability. In spring season PQP (*Plectranthus–Quercus–Pinus*) with SSP (*Sorghum–Sarcococa– Plectranthus*), both showed 79% similarities. Summer communities had high similarities values and they were closely related. The similarity index expressed from 0 – 100%. No work has been done on similarity index of the study area and adjoins areas. The highest index of similarity was recorded between stand II and stand I, was 99 % followed by 87% between stand II & stand III and 94% between stand V and stand III. These communities were similar due to similarity in edaphic and environmental characteristics. Plant communities in winter season were poorly related. Malik (2005) also reported such types of findings while studying life form and index of similarity of vegetation of Ganga Chotti and Bedori Hills. The differences due to overgrazing, deforestation, soil erosion and uprooting of plants by nomads (Nazir & Malik, 2006). The studied area needs complete protection from these factors so that original life formcan exist properly.

Degree of Homogeneity

Analysis of frequencies of species in different stands for different seasons indicated that frequency classes mostly did not follow Raunkiaer,s law of frequency during spring season. The results showed that four stands out of five were not homogeneous. It means that stands I, stand II, stand IV and stand V had heterogeneous communities and stand III was homogeneous in spring season ((Table 1. 7). Similarly frequency classes in summer vegetation indicated that all stands were heterogeneous. The communities were heterogeneous during winter showing extreme level of disturbance both biotic and abiotic factors. Only stand two was homogeneous.

Regeneration Capacity

Table 1.8 indicates age and population status of a community. It was determined by classifying woody plants into different diameter classes. Those plants were considered whose diameter higher than 15 cm. Regeneration capacity of spring flora of Oona revealed that trees like *Ficus racemosa, Melia azadrichta, Morus alba, Morus nigra* and *Olea ferruginea* did not exceed class iii i.e. their diameter ranged between 16 cm – 75 cm. *Pinus wallichiana* and *Quercus* species were the aged species of the site. Other leading species was *Ailanthus altissima.* It is spreading very fast. In summer season, the age classes improved showing increase in diameter. The trees lie *Salix tetrasperma, Robinia pseudocacia,Pyrus pashia, Morus alba* and *Diospyrus kaki* were lower down and had not showed growth due to severe pressure. In winter season, age groups indicated that *Pinus wallichiana* showed the growth with *Pinus roxburghii* and *Quercus dilatata* and *Q. incana.* Table 1.8.1 showed that regenerating capacities of the tree species in spring season. It is helpful to determine population status and age classes of trees. A total of 9 tree species were recorded in spring season, 15 tree species in summer and 13 were in winter season. *Quercus dilatata* had not shown regenerating capacity because it was under serious stress as it has high demand as fuel wood. In all the studied tree samples, no tree species had shown regeneration. No saplings of trees were noted during investigation of the area. As Fig. 1.1 showed tree species in patches. If it were not prevented, very soon the area will fail to spot trees like other habitats.

Constancy

It showed that how a species is uniformly distributed in a number of stands of the same type of community. The results revealed that large number of species in

class IV and V were not found i.e. indicated that floristic homogeneity in the community.

In spring season, *Dichanthium, Berberis, Sorghum, Plectranthus* had high degree of constancy, indicated that these species had wide range of ecological amplitude and therefore capable of growing in various micro habitats. In summer aspect, *Plectranthus, Cynodon, Cannabis, Dichanthium* and *Poa annua* were in class IV and V and had high ecological amplitude. They were found in variety of habitats that had similar environmental conditions.

Berberis lyceum and *Ailanthus altissima* were the most prevailing species in the area. They had highest constancy values indicated high ecological amplitude. These plants reached to the peaks especially *Ailanthus altissima.*

Constancy classes showed that *Cynodon dactylon, Dichanthium annulatum, Berberis lyceum, Plectranthus rugosus, Indigofera hetrantha* were occurred in class V i.e. 80 - 100% in spring season. These species had low fidelity and high ecological amplitude. Rest of the species in communities showed low amplitude and were restricted microhabitats. *Poa annua, Cynodon, Cannabis, Plectranthus* and *Dichanthium* were occurred in class V and had high ecological amplitude.

Biomass

Biomass of the spring vegetation of Oona site indicated that *Brachiaria reptens* and *Conyza aegyptica* had the highest content of 2240 kg/hec biomass each followed by *Artemisia vularge* (1800kg/hec) and *Dichanthium annulatum* (1748 kg/hec) in stand I. Th shruby layer had the lowest accumulation of biomass i.e. due to cutting and pruning in stand one. *Sorghum hephalensis* had high content of biomass i.e. 12960 kg/hec in stand II. The plant is not used in juvenile stage due to certain chemical substances that causes death of the cattle. In stand III, *Aristida depressa* (30720 kg/hectare) and *Sorghum hephalensis* (29280 kg/hectare) had higher biomass. *Cynodon dactylon* and *Salvia moorcroftiana* showed the high biomass in stand IV. In stand V *Cannabis sativa* (4932 kg/hectare) accounted for high biomass content followed by Xanthium *strumarium* (2620 kg/hectare). Results revealed that *Sorghum hepalensis, Cannabis sativa, Dichanthium annulatum* had yielded more than other forage plants. Hidalgo & Cauhepe (1991) had similar results. The *Poa* and *Stipa* species increased in cold season. The date and grazing history can be used as biomass predictor. Khan *et al.* (1999) stated that due to uncontrolled grazing, the range has

degraded from its productive potential. Sarmiento *et al.*(2004) reported that grazed savannah yielded much more forage as the un grazed.

Cluster analysis and DCA (Deterended Correspondence Analysis)

Detrended correspondence analysis was used to classify species. It is used to study pattern of distribution of species and major communities. Dendrogram, Twinspan and DCA were obtained to use different groups.



Fig. 2.1



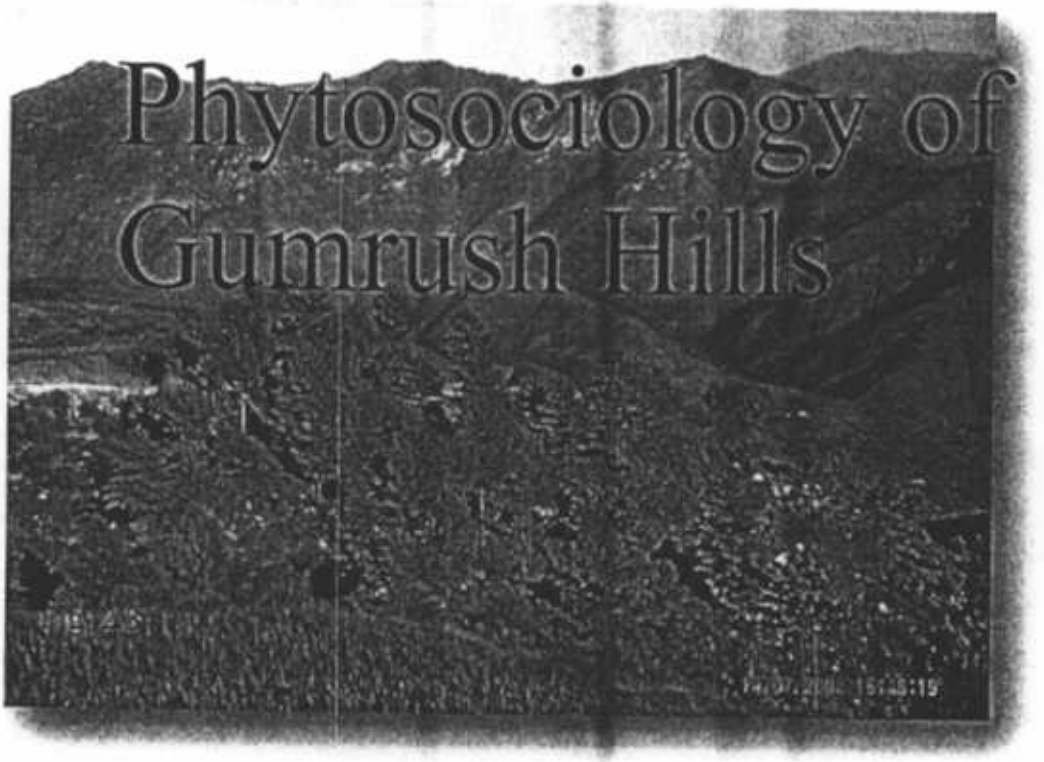




Fig.



Gumrush Hills

Gumrush Hills are located 34^0 47′ 0″ N and 72^0 48′ 0″ E. It is situated on south of the Chakesar Valley. A perennial stream is flows at the bottom from west to east direction, that receives water in summer from snow melt. It is a source of sand for locals which are used for construction. The area was hit by Tsunami earth quake in 8 October, 2005 which increased the demand for sand.

The altitude of Gumrush Hills ranges from 1300 m to 2000 m. In the foot hill, people have leveled the lands where agroforesty and agriculture is practiced. The area was also rich in fruit plants. The inhabitants are local to the area by descendants. As we go upward, the forests become thick. The locals opinioned that thick forests had existed from top to bottom in the past with rich diversity of flora and fauna. Thick forests exist in mid and top hill due to inaccessibility. The site is of arid type with *Quercus* forests. In the northern aspect of the top hill, *Quercus* species were dominant. This point is known as Bunj Kandao (*Quercus* area). In the south aspect of the Gumrush, pine forests were established.

The Hill Top at 2000m has some flat plains, two ponds, an old graveyard (depicting picture of the past vegetation) and fields terraces in strips (Fig. 2.5). This is boundary between Torghaza (previous Kala Dhaka of Hazara division) and District Shangla, which is separated by River Indus.

These hill were divided into different stands for phytosociological study starting from foot hill to the hill Top. The different communities established in spring, summer and winter aspects are outlined as follow.

Spring Aspect

1. ***Berberis – Ailanthus – Zanthoxylum* Community (BAZ)**

This community was established at Shabavara with 1250 m altitude. It is composed of 17 species which comprised of 11 herbs, 2 shrubs and 4 trees. The dominant members of the community were *Berberis lyceum* (IV= 196), *Ailanthus altissima* (IV= 115) and *Zanthoxylum armatum* (IV= 103). *Berberis lyceum* and *Ailanthus altissima* grew lavishly from foot hill up to the top hill vegetation. Inaccessible slopes played vital role in its existence and hindrance for land leveling. Other important species included *Conyza aegyptica* (IV= 80.6), *Cynodon dactylon* (IV= 77.8) and *Juglan regia* (IV= 69.2) (Table 2.1.1). Although every vegetation layer was analyzed independently yet the behavior of plant components of the lower

strata are to a large extent controlled by the tree or dominant canopy layer (Daubenmire, 1974). Similarly, all dominant groups of herbs, shrubs and trees were under these three major groups (Hussain *et al.*, 1993). *Ailanthus* is a frequently grown tree in the area. Dominance of this tree species indicated disturbance and secondary succession in the area. It is said by the local people that they heard from their forefather that the area was rich in *Pinus* forest. People have cut the forest. *Berberis* and *Zanthoxylum* were frequent in the stand due to their spin nature and non palatability (Hussain *et al.*, 1993).

The air temperature was 92.3 F^0. PAR light calculated was 775 µM/mΛ2S, and leaf wetness was 14. Solar radiation received by the stand was 1040 Wat/m^2. The relative humidity was 56.7% and wind was blowing in east direction with 10mph at 31^0 (Table 2.5). Generally, the soil temperature was due to the low cover.

The biological spectrum indicated the dominance of therophytes (47.1 %), followed by microphanerophytes. In leaf size spectrum, microphyll with 41.2 % dominated all other classes. The environmental and edaphic data explain that the stand had supported only those species which can withstand high temperature and intense radiation, with open cassopy.

2. ***Berberis – Pennisetum – Olea* Community (BPO)**

Berberis – Pennisetum – Olea community developed in Totash at height of 1350 m.It was dominated by *Berberis lyceum* (IV= 246.1), *Pennisetum orientale* (IV= 140.9) and *Olea ferruginia* (IV= 90.8). The co-dominant species included *Pyrus pasia* (IV= 80.4), *Salix tetrasperma* (IV= 65.3) and *Morus nigra* (IV= 63.5) (Table 2.1.2). This community reflects subtropical deciduous forests (Hussain *et al.*, 1993).

Environmental variables included air temperature $92F^0$, with PAR light 770 µM/mΛ2S and leaf wetness was 15. The habitat was moist as recorded by Watchdog weather station. Habitat was open and received solar radiation of 1420 Wat/m2. Relative humidity in the atmosphere recorded was 59.5% and wind was 4mph (Table 2.5).

The community is supported by 15 plant species which included 9 herbs, 2 shrubs and 4 trees species. Therophytic vegetation with 53.3 % dominated the stand coupled with microphyll leaf form as dominant.It was followed by nanophyll and leptophyll classes.

3. *Berberis - Pennisetum – Pinus* Community (BPP)

This community at Totash Dehri developed with 1400m was dominated by *Berberis lyceum* (IV= 219.6), *Pennisetum orientale* (IV= 147.2) and *Pinus roxburghii* (IV= 136.4). *Quercus baloot* (IV= 110), *Indigofera hetrantha* (IV= 71.5) and *Dichanthium annulatum* (IV= 63.8) were next important species. The Community comprised of 15 plant species including 8 herb species, 3 species of shrubs and 4 species of tree (Table 2.1.3). Human interference and seasonal activities changed the structure of communities (Hussain *et al.*, 2010). Woody and perennial plant species remained the same while composition of community changed due to dominance of annual during spring and summer which described seasonal effects (Malik *et al.*, 2007).

The air temperature recorded was 90.3 F^0, PAR light in the stand was 680 µM/mΛ2S and leaf wetness (LW) was 0, indicating dried situation of the habitat. The Totash Deri received total radiation 1420 Wat/m2 with relative humidity 61.2 % and wind speed was 7 mph (Table 2.5).

Therophytic (26.7 %) species dominated these stands, followed by hemicryptophytes (20 %) and microphanerophytes (20 %). The leaf form spectrum indicated that most dominant leaf size class was microphyll (80 %).

4- *Berberis – Cotoneaster – Isodon* Community (BCI)

This community was established at 1550 m in Manga altitude. It is dominated by *Berberis lyceum* (IV= 118.5), *Cotoneaster* (IV= 109) and *Isodon rogusis* (IV= 72). The soil temperature of the stand was 31 C^0. It had occupied north aspect of the hill and had also moist habitat. The stand is supported by 17 plant species in which 14 were herbs and 3 were shrubs. The area is prone to land sliding and biotic pressure. Other prominent species were *Brachiria reptens* (IV= 49.42), *Duchesnia indica* (IV= 57.37) and *Circium wallichi* (IV= 27.5) (Table 2.1.4).

The stand had 87.8 F^0 temperature, 547 µM/mΛ2S PAR, leaf wetness 14, solar radiation 1505 Wat/m2, relative humidity 56.3 % and wind blowing with 2 mph (Table 2.5). Environmental factors such as soil, temperature, humidity, rainfall, wind and biotic factors are important to mould vegetation structure according to its types (Malik *et al.*, 2007)

The life form spectrum indicated that therophytes were dominant life form class and microphyll dominated leaf size classes.

5- ***Berberis – Celtis – Quercus*** **Community (BCQ)**

This stand is located at Gumrush Dehri with 1800 m altitude. It is dominated by *Berberis lyceum* (IV= 156.9), *Celtis australis* (IV= 127.3) and *Quercus dilatata* (IV= 114.9). It is west aspect and had 29 C^0 soil temperatures. *Poa annua* (IV= 95.5) followed by *Conyza bonnariansis* (IV= 87.9) (Table 2.1.5) were other associated species.

Environmental data as recorded showed that air temperature was in Gumrush Dehri 86.4 F^0, PAR light 664 µM/mΛ2S, leaf wetness 12 (LW) and solar radiation received by the habitat was 1325 Wat/m2. The wind speed was 6mph (Table 2.5).

Chameophytes dominated the life form spectrum and microphyll was dominant class of leaf form.

The present study correlates the vegetation structure to the edaphic and climatic conditions and proposes possible ecological approaches for the improvement of plant resources and socioeconomic conditions of the area. A lot of work has been done by Miller *et al.* (2000); Singh *et al.*, (2005) and Dasti & Malik, (2000).

Summer Aspect

1- ***Berberis – Indigofera – Cynodon*** **Commuity (BIC)**

In the foot hill vegetation, south face slope of Gumrush hills at 1250 m altitude,was composed by the dominance of *Berberis lyceum* (IV= 132.2), *Indigofera hetrantha* (IV= 107.6) and *Cynodon dactylon* (IV= 95.1), along with *Populus indica* (IV= 72.2), *Ailanthus altissima* (IV= 62.1) and *Pyrus communis* (IV= 62.5) of the 30 reported species, 21 were herbs, 3 shrubs and 6 trees. The soil temperature was 28 C^0. (Table 2.2.1).

Biological spectrum showed that microphanerophytes (33.3%) dominated life form classes followed by cryptophytes (23.3 %) and nanophyll (46.7 %) were dominant leaf form, followed by microphyll (30 %). The Raunkiaerian life form spectrum was mainly of hemicryptophytes and the phanerophytes. The former prevailing in the site with open physiognomies and the later in the closed physiognomies (Batlaha & Martins,2005).

2- ***Berberis –Celtis – Quercus*** **Community (BCQ)**

Stand 2 is composed by 16 plant species including 7 herbs species, 6 shrubs and 3 tree species. *Berberis lyceum* (IV= 156.9), *Celtis australis* (IV= 127.3) and *Quercus dilatata* (IV= 114.9) were dominant. *Morus alba* (IV= 57.7), *Sarcococa*

saligna, Vitis, Hedra helix, Rosa macrophylla and *Plectranthus rogosus* (Table 2.2.2) were associated species. Herbaceous vegetation was therophytic in nature, exhibiting maximum number of species during rainy season.Therophytic, microphanerophytes vegetation dominated while microphyll (37.5 %) and mesophyll (31.2 %) were the leading classes of leaf size spectrum.

3- *Berberis – Pyrus – Quercus* Community (BPQ)

This stand is located at 1450 m altitude on south aspect of the slope. The habitat conditions supported *Berberis lyceum* (IV= 213.5), *Pyrus communis* (IV= 161.36), and *Quercus incana* (IV= 138.6). A total of 26 plant species were recorded containing 21 herbs, 3 shrubs and 2 tree species (Table 2.2.3). Life form indicated dry and disturbed vegetation i.e. therophytes dominated followed by chameophytes. Microphyll and nanophyll were dominant leaf form spectrum.

4- *Berberis – Fimbristalis - Thymus* Community (BFT)

Berberis – Fimbrystylys – Thymus community was developed at 1550 m on north face of the hill the conditions were moist. There were 29 species that included 15 herbs, 6 shrubs and 8 species respectively in the herb, shrub and tree layer. The soil temperature was 31 C^0. The dominant species were *Berberis lyceum* (IV= 132.3), *Fimbrystylys squarrosa* (IV= 80.7) and *Thymus serpyllum* (IV= 73.8) (Table 2.2.4).

This closed rangeland had greater plant diversity and better growth. The vegetation dependant on soil texture, physiographic features, soil depth and soil chemical characteristics Papanastasis *et al.* (2000). Therophytes with (27.6 %) followed mesophanerophytes (24.1 %) and cryptophytes 6 (20.7 %) were leading classes of biological spectrum while microphyll (51.7 %) and mesophyll (34.5 %) in leaf form spectrum.

5- *Cynodon – Berberis – Thymus Community* (CBT)

This stand had occupied hill top on west aspect at 1800 m where the soil temperature was 29 C^0 with dry habitat conditions. (Table 2.2.5). *Cynodon dactylon* (IV= 101.4), *Berberis lyceum* (IV= 98.7) and *Thymus serpyllum* (IV= 81.7) were dominant 18 species. Among them 14 were herbaceous plants and 4 were shrubby plants. Tree layer was missing as the stand existed on flat plains where excessive

cutting and deforestation had removed the tree layer and the regeneration is severely hampered.

Therophytes dominated life form spectrum and microphyll was leading group of leaf size classes.

Winter Aspect

1. *Berberis – Rumex – Tagetes* Community (BRT)

During winter, the foot hill supported very poor vegetation due to prolonged winter prolonged. The stand had 7 species in which 5 were herbs and 2 were shrubs. The leading dominant species were *Berberis lyceum* (IV= 269.2), *Rumex hastatus* (IV= 125.5) and *Tagetes erecta* (IV= 75.5). The associated species found in the stand were *Rubus fruiticosus, Conyza aegyptica* and *Chenopodium album* (Table 2.3.1). Water stress decrease alpha and beta diversity during community establishment (Cayuela *et al.*2008). The invader plant species, which were widespread in unprotected areas, were being replaced with desirable forage tree and grass species in protected areas Ahmad *et al.*, (1998). Index of diversity and its components equitability, species maturity decreased from low altitude to high altitude. The soil temperature decreases as the altitude increases Dastagir *et al.*, (1999). Natural and xerophytic vegetation has changed into mesophytic type due to large scale cultivation of trees (Ahmad & Khattak, 2001). Chameophytes (57.1 %) and microphyll (71.4 %) were dominant classes in biological spectrum.

2. *Zanthoxylum – Berberis – Cenchrus* Community (ZBC)

This stand was dominated by *Zanthoxylum armatum* (IV= 173), *Berberis lyceum* (IV= 127) and *Cenchrus ciliaris* (IV= 87.3). A total of 7 species included 5 herbs and 2 shrubs were recorded. Most of the species were in dormant conditions. The species like *Tagetes erecta, Conyza aegyptica, Rumex hastatus* and *Cirsium wallichi* were in dried condition (Table 2.3.2). The life form indicated that cryptophytes and nanophanerophytes were prevailing classes while microphyll and leptophyll had (71.4%) and (28.6 %) respectively.

3. *Ailanthus – Cenchrus – Diospyrus* Community (ACD)

Ailanthus altissima (IV= 169.4) *Cenchrus ciliaris* (IV= 96.6) and *Diospyrus kaki* (IV= 77.4) dominated the community. This community was supported by 10 species which comprised of 6 herbaceous layer, the *Berberis lyceum* and 3 species

were trees (Table 2.3.3). All size classes of life form were met in the stand indicated mature ecosystem. Microphyll was the dominant class and contributed (40 %).

4. *Pinus – Debregesia – Cenchrus* Community (PDC)

The dominant species of the community were *Pinus wallichiana* (IV= 256.7), *Debregetia salisifolia* (IV= 183.8) and *Cenchrus ciliaris* (IV= 134.2). Eight plant species were recorded in this community (Table 2.3.4). Like the previous community, this stand had also equal contribution of each class of life form spectrum. Microphyll was dominant class in leaf form spectrum (62.5 %).

5. *Pinus – Indigofera – Cynodon* Community (PIC)

This community was established in the top hill and was supported by 7 species included 3 from herbaceous layer, 2 from shrubby layer and 2 from tree layer. The leading species were *Pinus wallichiana* (IV= 247), *Indigofera hetrantha* (IV= 183) and *Cynodon dactylon*(IV= 134). These species were dominant members of the stand on the basis of importance values. Biological spectrum indicated that chameophytes and nanophanerophytes were dominant life form classes and microphyll was dominant leaf form spectrum.

Edaphic Characteristics

Natural habitat changed due to growing human population, transportation. Other processes results into accelerated biological invasion has been occurring the world over (Turner *et al.*, 2004; Shameem *et al.*, 2011). Soil is an important that has maintained life on earth, it also help the growth of plants that strived human competition. Soil resource is limited and its chemical and physical properties are controlled largely by clay and humus (Buckman & Brady, 1967; Shameem *et al.*, 2011). Vegetation also changes the chemical and physical properties of soil. It improves the soil structure, infiltration and prevents erosion. Several studies dealing with various aspects of

vegetation from different areas of the region have been carried out from time to time (Dar *et al.*, 2001; Stewart, 1982). The Chakesar valley provides home to a large number of plant and animal species.

Physiochemical analysis of the Gumrush Hills showed that stands I, II and V had moist habitat conditions while stand IV was dried. Soil texture of stand I, IV and V were sandy loam while stand II and III had sandy clayey loam and sandy respectively (Table 2.4). Soil pH ranged 6.1 (stand III) to 7.8 (stand V), indicating

that it changes from acidic to alkaline. Stand I had neutral soil with pH 7. Soil pH influences the accessibility of plant nutrient and it is a good sign of forest fertility (Black, 1968). pH values ranged from 6.1 at stand III to 7.8 at stand V. Overall highest pH was recorded in Gumrush site. This range of pH was reported by Kharkwal and Rawat (2010). However, high pH at all stands may have been due to low organic matter and slow decomposition of surface litter over the years. Similar results pertaining to these observations were also reported by Raina (1988). Buckman and Brady (1967) and Keoghh and Maple (1972) have reported lower pH values during dry seasons. In general soils at two stands i.e. stand stand III and IV were acidic in nature. The acidic nature of soil was also reported by (Kala, 2005) in grazed and un-grazed soils of western Himalaya. Soil organic matter is one of the most significant soil components, along with stabilizing soil structure and humanizing infiltration rate. Similar observations in accordance to the present study were also reported by Kharkwal & Rawat (2010); Kharkwal *et al.* (2009) and Kumar *et al.* (2002). Electrical conductivity varied from 0.06 (stand I) to 0.32 (stand IV). Exchangeable sodium ranged from 0.2 to 0.4. Organic matter also was high in stand II, IV and V. It was low in stand III. Nitrogen (%) was recorded low in stand I and high in stand IV. Sebastia (2004) showed that the soil fertility is the main environmental factor in vegetation development. Moreover, topography has indirect effect on plant community distribution. Because topography effects soil for example, slope, aspect and micro topography will affect soil drought and moisture (Heydari & Mahdavi, 2009). Comparative values of total nitrogen at both sites revealed site I at higher side hence parallel to the findings of Lyaruu (2010). Phosphorus (%) also varied 5 (stand II) to the highest in stand III (76 %). Exchangeable potassium was recorded highest in stand III and lowest in stand I & V.

Index of Similarity

Disturbances are natural events in all these sites that modify the vegetation structure. Similarity index determines resemblance among the the plant community. Table 3 shows that during spring aspect, stands II and stand I, stand III and stand II very closely resembled with 97 % and 81% SI values. Stands III & I, IV & I, IV & II, and fall in mid stages of the succession. They had IS between 26 – 50%. Stand V & II, IV & III, V & III were in late stages. While stands V & I were only 23 % similar and both had showed early stages (Table 2.6). A high degree of dissimilarity of herbs and grasses in such land uses has been reported by Verma *et al.* (2005). Shameem *et*

al., (2011) also reported similarity of 15.3 % in summer and 4.5% in winter vegetation.

Summer aspect did not show a potential natural community. Only two stands i.e. II & III and V & IV were in late stages while all other had showed mid stage developments except stand V & II that are at early stage. It had 25 % SI values. In winter aspect, stand II & I and V & IV were in late stage and had IS values between 51 – 76 %. Stands IV & I, V & I were in early stages with 14 % SI values.

Species Richness

A total of 80 plant species were recorded during spring aspect in Gumrush Hills. Each stand ranged from smallest number of 15 (stands II & III) to largest 17 numbers (stands I & IV). It is obvious that stand I & IV were located in open area where specie richness was high as compared to other stands. The disturbances were also low in these stands. The stands II & III had low species richness (0.46 & 0.536 respectively). These stands were subjected to disturbances such as land sliding and flood. Generally, the species richness in spring aspect was intermediate between summer and winter (Table 2.7). Species diversity is one of the most important characteristics of a community that brings stability to the community or vegetation type. The nature of plant community at a place is determined by other species that grow and develop in such environment (Bliss, 1962). The general structure of species at both sites indicated increasing trend in their numbers mostly during spring and summer seasons. At a regional scale, patterns of species richness and similarity along altitudinal gradients were highly constant. In all regions a decline in non-native species richness with elevation, confirming the trends previously reported from individual regions (Marini *et al.*, 2009; Pauchard *et al.*, 2009).

A total of 123 plant species were recorded in summer season, indicated high species richness and explained temporal variation. Similarly, stands I & IV had shown maximum species richness (0.857 & 0.703) while stand II & III had 0.553 & 0.61 respectively. Area is closely related to the species richness, temporal changes and aspection and locality also matter a lot.

Winter aspect earns very low S values than all other aspects that were studied. Contrary to the previous explanation, stands I, II, IV & V had 0.4, 0.4, 0.2 and 0.2 values and were more exposed to drought and chill than stand III that had 10 species. It means that environmental factors also determined species richness. The decline in richness in temperate regions may also be related to low temperature (Marini *et al.*,

2009), (Ali *et al.*, 2010; Jakobs *et al.*, 2010); thus, the decline in species richness with increasing elevation reflects differing environmental gradients in different regions.

Index of Diversity (Abundance and Evenness) and Equitability

It is used to measure species diversity in a community. It is useful to understand more about community structure, rarity and commonness of a species. The diversity of stand I was higher than stand II and similarly equitability of stand I indicated that evenness is high and species were evenly distributed. Stand V had also 1.9 value of diversity and is much higher than stand II, III and IV. The evenness of stand V is also higher. Stands III & IV had shown lowest diversity values. These stands had also lower species richness. They also accounted for lower equitability values. a number of factors responsible for low diversity (Table 2.7).

In summer aspect, BPQ community had the highest index of diversity, followed by BIC community and CBT community. It is evident from Table 2 that the diversity was generally high in summer. The equitability of stand III was also high and it was low in BCQ community. The maximum amount of species during spring and summer season could be due to availability of moisture provided mostly by rains and through other environmental factors. Similar prototype of observations mirrored to the present study was also mentioned by Sharma & Upadhyay (2002). Alhassan *et al.* (2006) in their study reported similar factors responsible for the variation in species number and diversity. The species diversity in the present study ranged from 1.25 (winter) to 4.48 in summer and thus agrees with Sharma & Upadhyaya (2002) who reported a range like the present study. Comparatively, results of Shannon diversity at both sites fall within the range of the study carried out by other workers (Lalfakawma *et al.*, 2009; Yadav & Gupta, 2007; Kharkwal *et al.*, 2004; Kiss *et al.*, 2004; Shameem *et al.*, 2011).

Plant diversity and its distribution were very low in winter season. The results revealed that stand I experienced abrupt seasonal changes and it was badly influenced as it had shown low species diversity and had very poor even distribution in winter season. It attributed high species diversity at a site having high temperature due to slope aspect and less tree cover. Hence the findings are well-matched with our results.The stand V (PIC community) also had low diversity with uneven distribution. The changes in environmental factors, Edaphic, latitudinal and altitudinal changes accounted for these variations.

Maturity Index

It is quotient of the total of the frequency percentage of all the species in the community. It means that higher the frequency percentage of each species and smaller the number of sporadic species, the community will be more mature (Pichi Sermolli, 1948). Table 2 revealed that BCI community (stand IV) is more mature with 57.3 % MI (maturity index) value, followed by BPP community (stand III) by 49.3 value in the spring season. The less mature stand is II which had BPO community. It seems that MI increased with altitude and then decrease in stands IV & V indicated disturbances that leaded to the immaturity of the ecosystem and ultimately result in extinction of species. Similar trend was observed in summer flora but the % of MI values declined and had lower values than spring. In winter aspect, as the activities became rare and the flora showed little higher frequency % and stand IV (PDC community) had earned highest % i.e. 62.5 %. It was only community that is highly mature as the season proceeded, the disturbances reduced (Table 2.7).

Constancy

Constancy table is used to construct association table. Constancy in spring aspect showed that most species were rare in stand I, II and III. Most of the species were present in class 1 i.e. (1 – 20%) followed by class II i.e. seldom present. Stand IV had the highest constancy class V. it meant that most of the species were constantly present i.e. 80 – 100 %. The whole aspect showed that stand IV is homogeneous and had made the association which is the basic unit of vegetation and is abstraction obtained from number of lists of species from selected sites in the field (Kershaw, 1973). In summer aspect, the species constancy had also similar trends. Stand I showed ascending behavior in constancy classes. Most of the species belonged to the class I i.e. 1-20 %. While stand II had seldom dominant class with 21 – 40 %. All other stands had similar % and most members occurred in class II. Winter aspect, stand IV and V had most of the plant species constantly present i.e. class V (80 – 100 %). Only some members occurred in class II i.e. 21 – 40 %.

Degree of Homogeneity

Results in Table 2 showed that stands II and V were closely allied and near to be homogeneous according to Raunkiaer, s law of frequency. Stands II and IV supported similar community structure and had identical edaphic physiochemical characteristics.

In summer aspect, all stands were heterogeneous because moisture and amount of precipitation introduce new species into the stand that increased species richness and diversity.

In winter season, stand I close to the water channel and settlements sustained some diversity at low altitude. The topography and slope had also played its role to bring homogeneity in stand.

Regeneration capacity

In spring aspect, all stands comprised of 10 tree species in which only *Quercus baloot* reached to the class V of Table 4., followed by *Pinus wallichiana* had 28 plants in all analyzed stands. Its diameter reached 75 – 100 cm. this aspect of Gumrush hills dominated by *Quercus* forest. It is dry sub tropical forest. *Pinus* trees were found only in east and north aspect of the hill. Diameter classes indicated that forest had mainly Quercus trees and were found in different range of diameter classes. Other tree species are either newly introduced or remained as associated one. In summer season, *Quercus baloot* had improved and it occurred in VI diameter class. As described in earlier discussion, the only occurred *Quercus* forest in the area had increased few folds risk to its existence. Suggling and ruthless cutting are main causes of its extinction. A total of 14 tree species were recorded from foot hill to top hill. Other significant tree species included *Celtis australis, Ailanthus altissima* in at low altitude, *Quercus incana* and *Morus alba.*

Winter season had sown that *Quercus baloot, Pinus wallichiana* and *Pinus roxburghii* had showed significant growth during rainy season.

Biomass

Table 4.6 showed biomass of different species in various aspect of the year. It is evident that *Themeda anathera* had highest value of 3040 kg/hectare in all stands in spring season. It was followed by *Pennesitum orientale* (*2680* kg/hectare), *Conyza aegyptica, Xanthium* and *Ajuga bracteosa* had 2240 kg/hectare each. In shrubby layer *Berberis lyceum* had shown high productiviety (34210 kg/hectare) followed by *zanthoxylum armatum* 13760 kg/hectare. In summer season *Pennesitum orientale* accounted high amount of biomass of 30600 kg/hectare. It was followed by *Erogrostis japonica* (22680 kg/hectare), *Themeda anathera* (22560 kg/hectare) and *Amaranthus spinosus* (12840 kg/hectare).

In winter season, *Themeda anathera, Pennesitum orientale, Naustertium officinale, Dichanthium annulatum* (22760 kg/hectare) and *Convolulus arvensis* 1800

kg/hectare. The shrubby layer had also substantially decreased biomass production in winter.

The above results had shown that phytomass increased in summer followed by spring and the ultimately low productivity recorded in winter. Shrubby mass was 37237 kg/hectare. For Berberis lyceum followed by *Xanthium straumarium* 30544 kg/hectare.

Classification and Ordination

Plant species with importance values in different stands in various aspects of the year with relation to edaphic characteristics were analyzed with Deterended Correspondence analysis (DCA) this identified cluster of species in ordination space and verified groups of species. It had showed coherency with vegetation. Three different diagrams (Figs. 2.6, 2.7 and 2.7) were used to show the relationship and gradient between the different stands and to develop relation between them. In Fig. 2.6 distribution of all stands along axis 1 and axis 2 of ordination axes are given. The figure demonstrated a gradient along ordination axis 1 which could be related to altitude and slope on right of the figure. The stands on axis 2 related to habitat conditions with dry and moist habitats. In all these associations, the stand IV, V and VI were calculated in summer aspect. These communities had high species richness and index of diversity. The moisture contents were also greatly different than other communities. The stand III community was located in high disturbed zone of mid hill which had human settlements. The community of the stand is part apart from rest of the stands indicating winter aspect on top hill. The climate was very intense; temperature was low and only *Diospyrus kaki, Amarathus viridis* and *Rumex dentatus* found in shady side of rock ridges. The pattern distribution showed that there are generally three kinds of vegetation found in all aspects of the year in Gumrush. The group I comprised of (stand 4, 5 and 6), group II (stand 2, 7 and 8) and group III (stand III & IX). It was found that there were significant differences in importance values and other soil physiochemical properties of the communities. Hansen & Jansen (1972); Ali *et al.* (2004) and Ahmad *et al.* (2010) studies also supported our results. The DCA groups were also confirmed by Fig. 2.7 and Fig. 2.8.

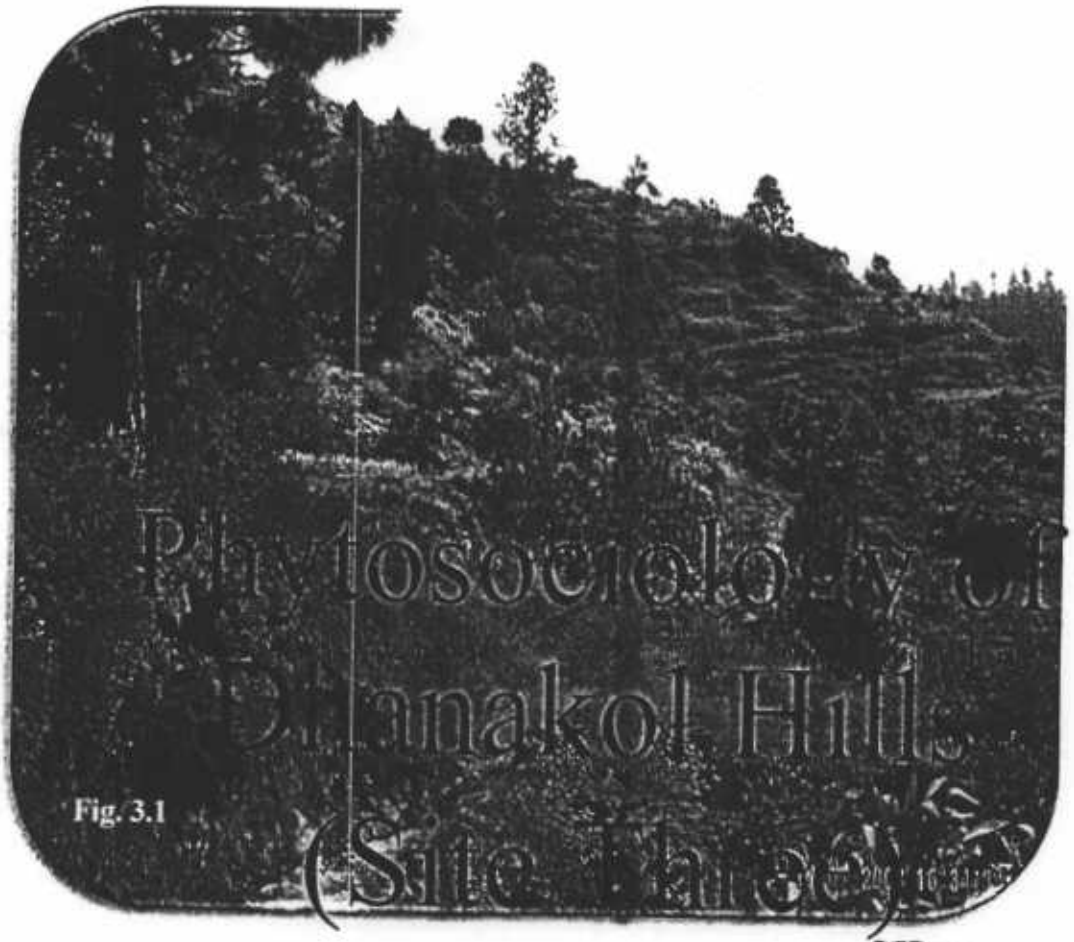


Fig. 3.1



Fig. 3.2



Dhanakol Hills

Dhanakol Hills situated at 34^0 46́ ˙O" N and 72^0 48' 0" E. Its elevation ranged from 4760 ft(1450m) to 6400 ft(1950m) asl. It was also divided into four stands and each stand was selected at distance of 100 m (328 ft). These were Khan China, Peech Lar, Saidan, Khadang and Dhanakol. The habitat structure varied from moist warm to dry. The hills aspects were from west to North West. The slope of the habitat also varied from 20^0 to 70^0. The vegetation height also varied from 25 ft to 170 ft. Total cover was in range of 60 % to 95 % depended on temporal variations. The area is under severe biotic and abiotic pressure. Land sliding, temperature fluctuation and intense changes in temperature both in summer and winter, heavy precipitation, grazing, cutting and pruning are involved in the deformation of natural structure of vegetation.

Spring Season

1. ***Ailanthus – Morus – Debregetia* Community (AMD)**

This community was established at elevation of 4760 ft (1450m) asl in Khan China. The habitat conditions were dry on the west aspect of the Dhanakol Hills making 20^0 slope. Total cover of the vegetation was 80 % and maximum vegetation height was 80 ft. A total of 18 plants were recorded, comprised of 13 herbs, 3 shrubs and 2 tree species. The dominant species were *Ailanthus altissima* (IV = 171.8) and *Morus alba* (IV =128.3) in tree layer. *Debregetia salisifolia* (IV =107) and *Berberis lyceum* (IV =101.6) in shrubby layer and *Cynodon dactylon* (IV =63.6) and *Poa annua* (IV =61.5) in herbaceous layer. *Ailanthus altissima* is an exotic species and extended to top hill area (Fig.3.2; Table 3.1.1). Similar findings were also obtained by Banjska (1977) and Knezevic *et al.* (1978). Some of the studies reported that altitudinal variation bring changes in structure of vegetation (Adhikari *et al.*, 1992; Saxena *et al.*, 1985) However, Puri *et al.*, (1983) stressed on geology and soils of habitat that may bring far greater change in the distribution of vegetation types than the altitude or climate.

Results in Table 3.5 depicted environmental characteristics that have a role in formation of vegetation structure. It included air temperature which was 94.5 ^{0}F, photosynthetically active radiation (PAR) was recorded 690 µM/mΛ2S. It occurred in the visible range which is very good in absorption of light to produce more food. Moisture in surrounding of plants was 13 LW. As it is cleared from Table 3.4, habitat was moist. It was an open aspection and receiving 1658 Wat/m2 solar radiation.

Relative humidity recorded in the stand was 62.9 %. It is also a cause of moisture availability in the area. A gentle breeze was blowing with 6mph in east direction with 265^0. The effects of environmental factors on structure of vegetation have been studied had same results (Semmar *et al.*, 2005; Telascrea *et al.*, 2006). Rainfall also important and changes vegetation structure (Perveen *et al.*, 2008).

Qualitative assessment of biological spectrum consisted of cryptophytes (31.5%), followed by therophytes (26.3%) and nanophanerophytes (26.3%). Cryptophytes and therophytes were dominant in the degraded and disturbed habitats (Durrani *et al.*, 2010). Leaf form spectrum indicated that leptophyll (31%), nanophyll (31%) and microphyll (26%) were dominant classes. This is well correlated with dry climatic condition and low precipitation. The small leaf classes were also reported by Qadir & Tareen (1987, 1991 and 1993) and Tareen & Qadir (1993). Durrani *et al.*, 2005 also reported similar trend for plants in Harboi rangeland. Our results agreed with the above findings.

2. ***Ailanthus – Dodonea – Indigofera* Community (ADI)**

ADI community was established in Peechlar at height of 5090 ft (1550m) asl on north west aspect of the hill. The habitat is located on 70^0 slope. Vegetation cover was 95% and height was 85 ft. This community comprised of 18 plant species in which 12 herbs, 3 shrubs and 3 were tree species. *Ailanthus altissima* (IV =162.3) was dominant species in tree layer, *Dodonaea viscosa* (IV =116.4) and *Indigofera hetrantha* (IV =107.3) were dominant members in shrubby layer. *Plectranthus rugosus* had (IV =75.8) in shrubby layer. The important herbaceous members included *Poa annua* (IV =60.7) and *Cannabis sativa* (IV =53.4). Some works on phytosociology (Ralhan *et al.*, 1982; Saxena & Singh 1997) and population structure (Saxena *et al.*, 1985; Singh *et al.*, 1987) of certain central Himalayan forest types have been reported.

An environmental factor like air temperature was 92.4 F^0 and relative humidity recorded in habitat was 56.2 %. The area is well suited for existence to perish their life cycle as PAR light (710 µM/mΛ2S) fall in best range for photosynthesis. Radiation (1450 Wat/m^2) received by the site is maximum and had depleted moisture content which made the stand dry. The leaf wetness noted was 0, indicating dried habitat. Wind was still.

The biological spectrum indicated that therophytes (33%) and chameophytes (22%) were maximum and the vegetation is called thero chameophytic. The

therophytes and chameophytes indicated high biotic pressure due to grazing and human interference while chameophytes characterized the colder climate and high altitude (Braun – Blanquet, 1932). Main threat to the vegetation cover is grazing and human encroachment and colonization in the wild habiats (Shah & Hussain, 2009).

Leptophyll (33%) and microphyll (44%) were deominant leaf form classes and it also represented dried environmental condition.

3. ***Ailanthus – Plectranthus – Berberis* Community (APB)**

This community was developed at altitude of 5450 ft asl. This community existed on west aspect at 65^0 slope. The soil temperature was 33 C^0 and color was brown. A total of 21 plant species were recorded in which 13 plants were herbs, 4 species were shrubs and 4 species were trees. The habitat was dried and was supported by *Ailanthus altissima* (IV=177.7) in tree layer, *Plectranthus rugosus* (IV=116.7) and *Berberis lyceum* (IV=82.2) were dominant species in shrubby layer. Other associated species included *Conyza bonariansis* (IV=80.5), *Cannabis sativa* (IV=62.5), *Impatiens edgeworthii* (IV=27.2) and *Mentha viridis* (IV=18.2). The stand had a water trench that people also used it to water their fields. The plants like *Scripus, Cyprus, Juncus, Mentha* and *Plantigo* species were growing there. Vegetation structure is influenced by soil characteristics (Perveen *et al.*, 2008).

An environmental factor like air temperature was 91.3 F^0 and relative humidity recorded in habitat was 55.1 %. The area is well suited for existence to perish their life cycle as PAR light (700 µM/mΛ2S) fall in best range for photosynthesis. Radiation (1438 Wat/m^2) received by the site is maximum and had depleted moisture content which made the stand dry. The leaf wetness noted was 1, indicating dried habitat. Wind was blowing with 3mph.

At 5450 ft, 21 plant species comprised of nanophyll (33.3%), leptophyll (23.8%) and microphyll (23.8%). The dominance of nanophyll and leptophylls indicated disturbed environmental conditions. In biological spectrum, therophytes were 8 species (38.09%), cryptophytes shared 4 species (19.04%) and microphanerophytes had 3 species (14.286%). Dominance of the therophytes also represent unbalanced environmental conditions in the area. Deforestation, soil erosion, overgrazing and human influences reduces the macrophyll, so therefore therophytes had occupied the niches that were not previously occupied by plants (Ajaib *et al.*, 2008).

4. *Plectranthus – Artemisia – Salix* Community (PAS)

This community was located on 5750 ft elevation on west facing slope of Dhanakol hill. The habitat conditions were moist and soil temperature was 31 ^{0}C. The dominant species of the community on the basis of importance values were *Plectranthus rugosus* (IV=259) in shrubby layer, followed by *Artemisia dubia* (IV=135.1) in ground layer and *Salix babylonica* (IV=66.3) making top canopy cover. Co dominant angiospermic trees species included *Alnus nitida, Ficus palmate, Diospyrus kaki, Morus nigra and Ailanthus altissima.* Ground flora was represented by *Rubus ellipticus, Tagetes erecta, Oxalis corniculata, Mentha viridis, Impatiens edgeworthii* and *Conyza bonariensis.* The Himalayan forest vegetation ranges from tropical dry deciduous forest in the foothills to alpine meadow above timberline (Singh and Singh, 1992). Composition of the forest is different and varies from place to place because of varying topography such as plains, foothills and upper mountains (Singh, 2006). Economically and environmentally, the natural resources are the main source for people in this region (Ram *et al.*, 2004). In addition, environmental problems are particularly noticeable in this region as a form of degradation and depletion of the forest resources (Sati, 2005).

An environmental factor like air temperature was 90.5 F^0 and relative humidity recorded in habitat was 52.9 %. The area is well suited for existence to perish their life cycle as PAR light (675 µM/mΛ2S) fall in best range for photosynthesis. Radiation (1227 Wat/m^2) received by the site is maximum and had depleted moisture content which made the stand dry. The leaf wetness noted was 14, indicating moist habitat. Wind was blowing with speed of 8 mph in south direction with 227^0.

From the analysis, it can be concluded that nanophanerophytes (18.75%) and microphanerophytes (12.5%) along therophytes (31.25%) were the dominant classes of life form. it seems that the plants like phanerophytes were dominant before degradation. Degraded vegetation maintains therophytic and hemi cryptophytic type of vegetation (Malik, 1986, Ram and Arya, 1991).

The leaf form spectrum explained that microphyll (50%) and nanophyll (31%) were leading in the area which showed disturbed vegetation types.

Summer Season

1. ***Rubus – Melia – Indigofera* Community (RMI)**

At 4760 ft, this community was present. Of 29 recorded plant species, there were 20 plant species forming ground layer i.e. herbaceous plants, 4 species were herbs and 5 species were trees. The habitat was moist and is located on west facing slope. The dominant species were *Rubus fruiticosus* (IV=95.2) in shrubby layer, *Melia azadarichta* (IV=88.5) in tree layer followed by *Indigofera hetrantha* (IV=88.3). The ground layer had *Cannabis sativa* (IV=76.4) followed by *Dicliptra roxburghiana* (IV=62.5) and *Brachiaria reptens* (IV=40). Community structures are important to analyze and interpret the plant species at different exposures and provide first hand information about the vegetation and basis for the prediction of future changes (Muller Dumbois & Ellenberg, 1974).

Qualitative assessment of biological spectrum indicated that therophytes (48.27%) and microphyll (13.79%). Sharma & Upadhyaya (2002) had same results and they studied foot hill vegetation and described that herbaceous vegetation was therophytic in nature. Saxena *et al.*(2004) described that the grassland vegetation characterized by hemicryptophytic while flora as a whole was therophytic. Our results described that habitat degradation had changed the structure of vegetation from phanerophytes vegetation to therophytic. Leaf form spectrum also agreed with the results that microphyll (37.9%) and leptophyll (31.03%) determine the vegetation of disturbed habitats.

2. ***Cynodon – Thymus – Berberis* Community (CTB)**

This community was developed at 5090 ft height on North West facing slope of the Peech Lar (locally the stand is called as *Pinus wallichiana* pavament). A total of 26 plant species were recognized in which 16 species were herbs, 6 species were shrubs and 4 were tree species. *Cynodon dactylon* (IV=106.3) was dominant species in ground layer. *Thymus serphylum* (IV=98.5) and *Berberis lyceum* (IV=89.0) were dominant members in the shrubby layer. All tree species had similar importance values and they shared equally to the tree layer. The tree layer made up of *Platanus orientalis, Celtis australis, Ficus palmate* and *Pyrus communis.* The important associated species of shrubs were *Desmodium elegans, Rosa macrophylla, Indigofera hetrantha* and *Rubus fruticosus.*

Microphyll (26.9%) followed by nanophyll (23.07%) and mesophyll (23.07%) were leading classes leaf size classes, therophytes (26.9%) followed by cryptophytes

(23%) and nanophanerophytes (15.3%) were the dominant classes in biological spectrum. Qualitative analysis indicated that vegetation changed from mesophyll and macrophyll to the nanophyll. Similar study was conducted by Perveen & Hussain (2007), Sher & Khan (2007), Hussain & Durrani (2009) and Hussain *et al.* (2009).

3. ***Ailanthus – Pinus – Berberis* Community (APB)**

APB community established at 5420 ft elevation on west sloping aspect of Dhanakol hills and is dominated by *Ailanthus altissima, Pinus roxburghii* and *Berberis lyceum.* Co dominant species included *Brachiaria reptens, Cannabis sativa, Cynodon dactylon* and *Poa annua* in ground layer, *Rubus fruticosus* and *Indigofera hetrantha* were making shrubby layer. The associated species of the tree layer included *Pistacia integrima* and *Ficus palmata.*

Hemicryptophytes (28%), therophytes (24%) and cryptophytes (16%) were the dominant life form classes and microphyll (40%), nanophyll (28%) and leptophyll (20%) were the leading classes of the leaf form.

4. ***Pinus –Pyrus – Indigofera* Community (PPI)**

This community was established at top hill vegetation and is dominated by *Pinus wallichiana* (IV=122), *Pyrus pashia* (IV=102.9) and *Indigofera hetrantha* (IV=79.3). Associated species included *Sarcococa saligna, Thymus serphylum* and *Berberis lyceum* of shrubby layer and *Cynodon dactylon, Impatiens balsiminea* and *Artemisia vulgare.* A total of 25 plant species were recorded in the area comprised of 17 herbs, 5 shrubs and 3 species of trees.

At 1750m, 25 plant species comprised of therophytes 36%, hemicryptophytes 24 %, cryptophytes 12 %, nanophanerophytes 12 % and mesophanerophytes 8 %. The vegetation was therohemicryptophytic. The stand also showed degraded vegetation. Microphyll (40%), leptophyll (20%) and mesophyll (24%) were leading groups of the leaf form classes.

Overall vegetation of Dhanakol hills was dominated by therophytes and hemicryptophytes and microphyll and leptophyll followed by nanophyll. As altitude increases, leaf size reduced significantly indicating dry and xeric condition. Large size leaves indicated cool and moist habitat conditions. As a whole, the vegetation was moist tropical in foot hill to dry tropical in mid hill and tropical hill.

Winter Season

1. ***Berberis – Tagetes – Rumex* Community (BTR)**

This community was developed at foot hill and was very short and consisted of 6 plant species comprised of 4 herbaceous species and 2 shrubby members. The leading dominant species were *Berberis lyceum* (IV=221) in shrubby layer and *Tagetes erecta* (IV=139.8), *Rumex hastatus* (IV=98.2) were leading dominant in ground flora. Co dominant species in ground stratum included *Conyza bonariansis* (IV=35.5) and *Ajuga bracteosa* (IV=26.4). *Zanthoxylum armatum* (IV= 78.9) was the only co dominant member of shrubby stratum.

Nanophyll (83.3%) was dominant leaf size class and microphyll (16.6%) was also representative class. The leaf form in the dormant season was only represented by nanophyll and microphyll as the results had shown. The only classes in the life form were found are therophytes, chameophytes and nanophanerophytes. Each class had contributed same (33.33%) percentage.

The results revealed that the area is under severe environmental pressure and size classes of leaf form and life form were depicted xeric conditions.

2. ***Berberis – Tagetes – Pinus* Community (BTP)**

The community was established and comprised of 9 plant species in which 6 plant species were herbs, one species of shrub and 2 species belonged to tree layer. The dominant members of the community in different strata were *Berberis lyceum, Tagetes erecta, Pinus wallichiana.* The co dominant species included *Quercus semicarpifolia, Artemisia japonica, Androsac rotundifolia, Duchesnia indica* and *Pteridium equilinium.* The aggregation of communities in the drier region can be easily interpreted to support the assumption (Malik and Husain, 2006). The cutting of trees and shrubs by people and the digging of valuable medicinal herbs are increasingly altering the composition and distribution of plants in the study area and its surrounding valleys. Goats and sheep are the main threat for the vegetation of the study area (Hussain & Perveen, 2009). Grazing pressure, becoming more intense each year and the habitat is being modified as observed in many sites.

9 plant species comprised of 55.6% leptophyll, 33.3% microphyll and 11.1% nanophyll. In life form spectrum, therophytes, cryptophytes, chameophytes, nanophanerophytes and microphanerophytes shared each 22.2% of the spectrum. The vegetation was showing dry harsh conditions of the habitat.

3. *Pinus – Tagetes – Indigofera* Community (PTI)

This community was supported by 9 plant species comprised of 4 herbs, 3 shrubs and 2 tree species. The community is dominated by *Pinus wallichiana* (IV=215) in tree layer, *Tagetes erecta* (IV=190.1) in herbaceous layer and *Indigofera hetrantha* (IV=119.4) in shrubby layer. Co dominant species in ground layer included *Pennisetum orientale, Rumex hastattus* and *Conyza aegyptica. Berberis lyceum* and *Plectranthus rugosus* in second layer. *Quercus incana* was the only associated species in tree layer. The community structure and distribution patterns of Himalayan forests and alpine pastures have not been given due attention till the date by the plant ecologists, and hence poorly understood (Peer *et al.*, 2007 and Shaheen & Qureshi, 2011).

In the life form spectrum, hemicryptophytes, chameophytes, nano and microphanerophytes shared equal percentage of 22.2 and therophyte were only 11.11 %. In leaf form spectrum, nanophyll dominated the leaf form spectrum followed by leptophyll and microphyll.

4. *Berberis – Dactylis – Indigofera* Community(BDI)

This community was located at top hill and was partially covered by snow. A total of 7 plant species were recorded in the community consisted of 4 herbs, 2 shrubs and a tree species. The dominant members included *Berberis lyceum* (IV=176) and *Indigofera hetrantha* in shrubby layer. *Dactylis glomerata* (IV=144) followed by *Pennisetum orientale, Poa annua, Androsac rotundifolia* made the herbaceous layer. *Pinus wallichiana* was the only tree species recorded in the community.

Hemicryptophytes (42.9%) and chameophytes (28.6%) were dominant classes of the life form spectrum followed by cryptophytes and microphanerophytes shared 14.3% each. In leaf form spectrum nanophyll (57.1%) and leptophyll (42.9%) made dominant categories of the spectrum.

The present research work showed that topography and biotic features determine the structure and distribution of vegetation. The vegetation under discussion is dry subtropical where its original form was moist subtropical forests. Degradation results in creation of grasslands and shrubs a dominant layer and open patches of habitats. The results revealed that some of the tree species were shifted from lower habitats to the top hill i.e. trees and important medicinal plants are found only in top hill area where its life is also in danger to be extinct in very near future. These species were very sensitive to grazing, deforestation and human population.

Their occurrence in one or in other communities may give important clue to te prehistoric nature of the area. Our findings agree with Sher & Hussain, (2009) and Sher & Al-yemni, (2011), who stated that a mature coniferous community changed to open habitats. Our results were also like that of Malik & Hussain (1987) who demonstrated that degraded scrubby forests which dominated non palatable, less preferred plant species.

Edaphic Characteristics

Results of edaphic characteristics of Dhanakol Hills revealed that stand I & IV had moist habitat conditions while stand II & III was dried. Soil texture revealed that all stands had sandy loamy soil. Sandy loamy soil is best for cultivation of crops and is considered fertile. Soil texture and structure changes vegetation cover from place to place (Perveen *et al.*, 2008). Soil pH ranged 4.6 (stand I) to 7 (stand IV), indicating that it was slightly acidic and it give optimum production. It supported the communities that were established there. Stand IV had neutral soil with pH 7. Electrical conductivity varies from 0.08 dSm^{-1} to 0.2 dSm^{-1}. All stands had normal to medium EC. All stands had EC values smaller than 2 which mean that soil had no salinity problem and were good to support the present type of vegetation. Exchangeable sodium was in range of 0.2 to 0.4. It is also in good range and it should be less than 1.0 mg $100g^{-1}$. Organic matter was high in stand III (2.03) and was low in stand IV (0.2). Nitrogen (%) was ranging between 0.038 % to 0.127%. Phosphorus (ppm) also varied 6 (stand IV) to the highest in stand I (10ppm). P content present in normal range. Exchangeable potassium (ppm) was recorded highest in stand I (90ppm) and lowest in stand II & IV (70 ppm). Normal level of K ranged 150 ppm to 200ppm. It seemed that K level was low than normal. Ilyas (1988) also established the same results for Kirbykuch enclosure. EC, calcium carbonate, bicorbonate, chloride and calcium plus magnesium were generally found to be low. Tareen (1986) reported similar results for Quetta district. Sodium adsorption ratio, potassium and potassium adsorption ratio ranged low in the present communities. Similar results were obtained by Sheikh *et al.* (1974) for irrigated soils of Loralai and Sibi districts. Plant communities are very distinct floristically, therefore, community maturity and community homogeneity are low. Hussain *et al.* (2008) and Sharma *et al.* (2009) found similar relationship between vegetation and soil parameters. The community structure and distribution patterns of Himalayan forests

and alpine pastures have not been given due attention till the date by the plant ecologists, and hence poorly understood (Peer *et al.*, 2007 and Shaheen & Qureshi, 2011).

Index of Similarity

Disturbances are natural phenomena on all sites and are necessary to continue ecological structure and function. Mountains host different life form due to different climatic zones. Similarity index determines that how closely look like the plant communities. In Table 5 comparative indices of similarities between different seasons in Dhanakol Hills had shown. In spring aspect, all stands were dissimilar and present in group I i.e. 1 – 25%. It represented early stages of development of community. The disturbances indicated that site was always under pressure after the winter (a dormant season). Summer aspect had not a community that has similarity beyond 50%. It had all the communities in 25 – 50 %. All the established communities lie in mid stages of development. In winter aspect, all stands showed some high percentage of index values than previous seasons. Only stand IV & I had dropped the similarity value and was under sudden biotic changes.

Species Richness

A total of 74 plant species were recorded in spring aspect in Dhanakol Hills. Each stand ranged from smallest number of 16 to largest 21 numbers. Smallest richness was recorded in stand IV and highest was 0.73 in stand III. A total of 105 plant species were recorded in summer season, indicated high species richness and explained temporal variation. Stand I & II had shown maximum species richness (0.8 & 0.7) while stand III & IV had 0.6 & 0.64 respectively.

Winter aspect earns very low S values than all other aspects. It ranged from 0.4 to 0.602. Harsh climatic conditions, prevailing low temperature and altitudinal and latitudinal gradients determined low species richness.

Index of Diversity (Abundance and Evenness) and Equitability

Table 5 revealed spring aspect had high diversity for stand II and low for stand IV. Stand II & III had almost similar values. Species diversity related to equitability and its distribution. High equitability recorded for stand II that had high diversity. Community II had even distribution of species and also high species richness.

In summer aspect, stand IV had high diversity and also equitability. Species richness and evenness recorded high in this stand. It perhaps due to inaccessibility to habitats and occurrence at a distance. Habitat degradation, overgrazing and climatic changes

responsible for species distribution and abundance. Species diversity was normally found to be low as obtained by Tareen and Qadir (1987) in the plains of Quetta district. However, this is in consistency with the observation of Tareen and Qadir (1987) for the communities of Hazarganji and Walitangi, Qadir and Ahmed (1989) for the wood land communities of Hazarganji. Biodiversity is constantly declining due to the activities of human kind (Krishnmurthy, 2003).

Species diversity and equitability declined in winter as environmental conditions become unsuitable to sustain plant life. Low diversity and its uniform distribution were set up in winter aspect. All stands had similar diversity and species distribution and evenness. Grazing practices are one of the important determinants of vegetation distribution patterns and having most obvious impact on the floral biodiversity of an area (Vallentine, 2001). Peer *et al.*, (2007); Shinwari and Gillani, (2002) and Shaheen & Qureshi, (2011) have studied different aspects of vegetation structure and distribution patterns in alpines of western Himalayas.

Maturity Index

It is frequency percentage of all the species in the community. The index values showed that community I had high value and is considered more established stand in the site in spring season. Lowest value recorded for stand III although it had high species richness. Plant distribution was in patches and habitat disturbance was prominent that resulted in low maturity.

Human activities reached to the peak in summer. All kinds of interferences with vegetation exercised and lead to hinder growth and germination. Low maturity showed by communities due to above mentioned causes. The low percentage of the community maturity indices may be recognized to the fact that communities of the study area represent successional stages. Qadir and Shetvy (1986) also reported low community maturity and low community homogeneity for Libyan plant communities, because these communities are also dissimilar floristically and differ in their stages of development.

Winter season accounted high maturity in stands than other aspect of the year. Communities remained intact and at onset of spring show full maturity.

Constancy

Poa annua had high constancy values in all stands than other species. Its fidelity is low and ecological amplitude high. It is most abundant species ranged from foot hill to the top hill in spring season. Other prevalent species included *Plectranthus, Artemisia dubia* and *Cynodon dactylon.* In summer aspect, *Cannabis sativa, Berberis lyceum, Sarcococa saligna* and *Cynodon dactylon* had values in class V of constancy class and showed very low fidelity. These species extended from base of the mountain to the top of the hill. In winter, *Tagetes erecta* is the most distributed species and almost found in all stands with high frequencies. Other species were *Berberis lyceum, Indigofera hetrantha* and *Dactylis glomerata* who had high ecological amplitude.

Degree of Homogeneity

Table 5 showed that frequency classes in spring aspect had not followed Raunkier law of frequency. All stands were heterogeneous. In summer season, stand IV followed Raunkier law of frequency classes and community was homogeneous while all other stands were heterogeneous. Stand III was also nearly homogeneous. Winter aspect had all heterogeneous communities because they had not followed Raunkiaer, s law.

Regeneration Capacity

A total of 9 tree species were recorded in the spring season in Dhanakol site. *Ailanthus altissima* was dominant species and had 16 plants in the quadrats followed by *Ficus palmate.* These tree species had diameter in range of 76 – 100 cm except *Salix tetrasperma,* whose diameter reached to 126 – 150 cm. In summer season, *Ailanthus altissima* reduced to 6 individuals. All other plants exponentially reduced in their diameter classes except *Ficus palmate* had improved its position. Perhaps it was due to its sacred nature that is famous in local community, respect it and conserve it. In winter season, *Ficus palmate, Pinus wallichiana* and *Ailanthus altissima* had shown considerable growth.

Biomass Production

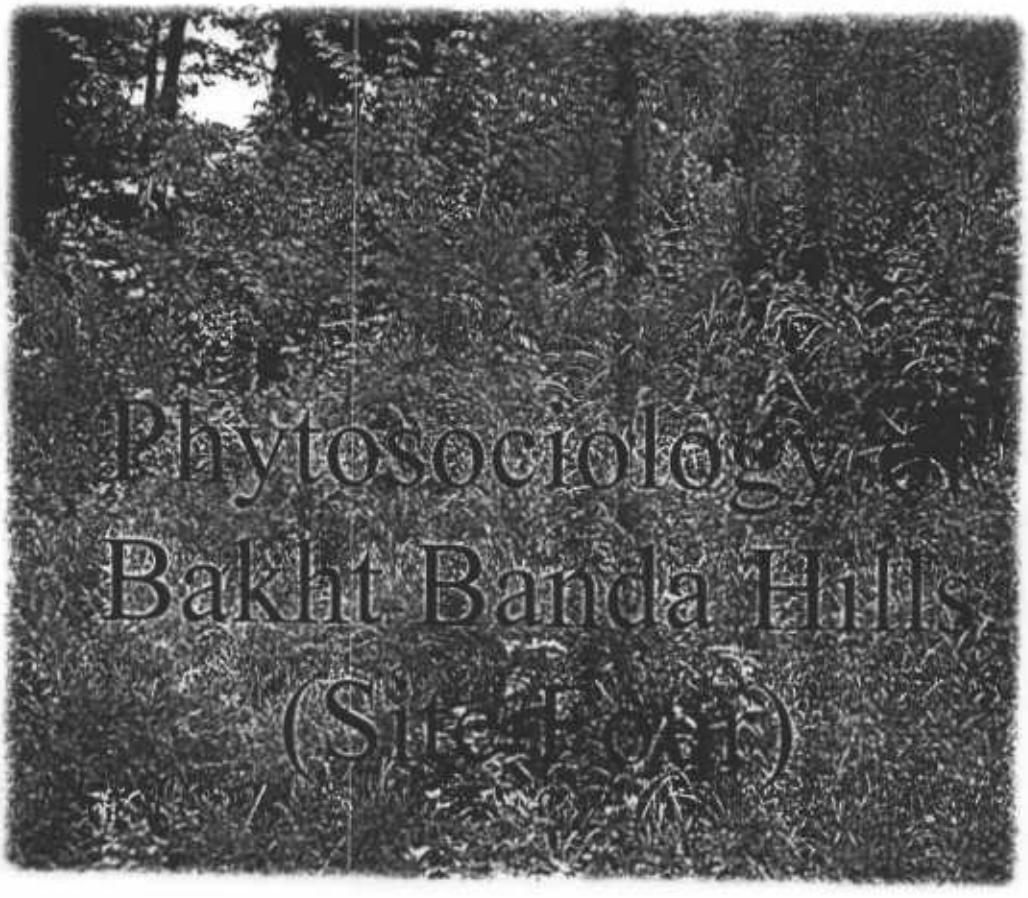
Biomass production indicated that *Cynodon dactylon* (17280 kg/ hectare) and *Saccharum spontanum* (17280 kg/hectare) followed by *Rumex hastatus* (13680 kg/hectare), *Cannabis sativa* (12840 kg/hectare) and *Poa annua* (9240 kg/hectare) were leading herbaceous species with high productivity in the site. Generally all investigated plants had shown high productivity in summer season. The other plants with their productivity included in herbaceous layer included *Ajuga bracteosa* (3040 kg/hectare), *Tagetes erecta* (348 kg/hectare), *Oxalis corniculata* (645kg/hectare) and *Impatiense edgeworthii* (873 kg/hectare).

DCA analysis of Vegetation

Plant species and their importance values in different stands were analyzed with Deterended Correspondence analysis (DCA) which had identified cluster of species in ordination space and verified groups of species. It had shown coherency with vegetation. Three different diagrams (Fig. 3.10, 3.11 and 3.12) were used to show the relationship and gradient between the different stands and to develop any relation between them. In Fig. 3.12 distribution of all stands along axis 1 and axis 2 of ordination axes are given. The figure demonstrated a gradient along ordination axis 1 which could be related to altitude and slope on right of the figure. The stands on axis 2 related to habitat conditions with dry and moist habitats. In all these associations, the stand group I, II, III and IV are closely related. These communities had high species richness and index of diversity. Our DCA and TWINSPAN results were mostly similar and plant communities classified by TWINSPAN were confirmed like that of Ahmad and Yasmin (2011). The moisture contents were also greatly different than other communities. It was found that there were significant differences in importance values and other soil physiochemical properties of the communities. Hansen & Jansen (1972); Ali *et al.* (2004) and Ahmad *et al.*(2010) studies also supported our results. The DCA groups were also confirmed by Figure 2.7 and Figure 2.8.






Phytosociology
Bakht Banda Hills
(Sirsawa)

Bakht Banda

Spring Season

1. *Pinus – Plectranthus – Indigofera* Community (PPI)

This community was established at altitude of 1975m. Soil color is brown with 23.5 ^{0}C soil temperature. Topography indicated that slope is very steep of 60^{0}. This stand is located at north face of the mountain. The habitat conditions were very moist and vegetation type is moist temperate. This site is starting point of Chakesar valley and is totally different in climate and weather conditions from other sites. The dominant plant species on the basis of importance values were *Pinus wallichiana* (IV =195.5) in tree layer, *Plectranthus rugosus* (IV = 173.9) and *Indigofera hetrantha* (IV = 80.6) in shrubby layer. Herbaceous layer was very poorly developed. It was a partially shady habitat. Associated species were *Quercus dilatat* (IV = 35.7), *Hedra helix* (IV = 26.5) and *Ailanthus altissima* (IV = 42.4) in tree layer. In shrubby layer, *Sarcococa saligna* (IV = 30.8). Some of the important herbaceous species included *Artemisia vulgare* (IV = 28.8), *Arisaema flavum* (IV = 30) and *Urtica dioca* (IV = 13.2) (Table 4.1.1; Fig. 4.1).

The site is located at high altitude with differences in environmental variables. At 1975m altitude air temperature was 80.5 F^{0}, relative humidity was 69.7 % with wind blowing with speed of 16mph in northern direction. The photosynthetically active radiation fall in wavelength of 784 µM/mΛ2S. Leaf wetness value was 14. It indicated moist condition showed that the forests are moist temperate. Solar radiation fall on the stand was 1560 Wat/m2.

The biological spectrum for qualitative life form showed that therophytes (spp., 40%) was the dominant life form followed by cryptophytes (3 spp., 15%) and chameophytes (spp., 4=20%). Qualitative leaf spectra showed that microphyll was dominant (10 spp., 50%) followed by nanophyll (6 spp., 30%). Shah & Hussain (2009) reported that therophytes were dominating and indicated that habitat supported the plants for short lived annuals.

2. *Pinus – Indigofera – Bromus* Community (PIB)

This community was present at 2100m elevation on west facing aspect with 55^{0} slope. The habitat conditions were moist and soil color was brown. The soil temperature was 22 C^{0}. A total of 16 plant species were recorded in which 9 species were herbs, 5 were shrubs and 2 were trees. *Pinus wallichiana* (IV = 217) was dominant species in tree layer followed by *Indigofera hetrantha* ((IV = 167.3) and

Bromus japonica (IV = 87.7). Other associated species in tree layer included was *Picea smithiana* (IV = 83) and *Plectranthus rugosus* (IV = 87.7), *Rubus fruticosus* (IV = 32.9) and *Vibernum grandiflorum* (IV = 9.6) in shrubby layer. In herbaceous layer, the important species were *Viola biflora* (IV = 17.9) and *Artemisia vulgare* (IV = 63.5) (Table 4.1.2).

Environmental variables included air temperature 76.7 F^0, PAR light was 670 µM/mΛ2S and leaf wetness was 14. Leaf wetness measures the moisture in surrounding of plants. It was a measure of resistance of water. It indicated that stand was moist. The habitat received 1020 Wat/m^2 indicates that habitat received enough radiation sufficient for maximum productivity. Relative humidity was 68.7 % with wind 37 mph speed at direction of 62^0 toward east.

The life form spectrum showed that therophytes (spp., 8 = 50%) was dominant life form class followed by nanophanerophytes (spp., 4 = 25%). Leaf form spectrum showed that microphyll (spp., 10=62.5%) was dominant leaf form class followed by leptophyll and macrophyll (spp., 2=12.5%) each.

3. *Pinus – Berberis – Cannabis* Community (PBC)

The PBC community (*Pinus – Berberis – Cannabis*) developed at 2225. This community was supported by 15 plant species in which 9 herbs, 4 shrubs and 2 trees. The *Pinus wallichiana* ((IV = 191.9) in tree layer, *Berberis lyceum* ((IV = 169.3) in shrubby layer and *Cannabis sativa* ((IV = 128.2) in herbaceous layer were the dominant members of the community. The associated species in tree layer was *Quercus dilatata* ((IV = 108.1). Tree species were dominating in all stands. It had made dominant layer and had emergent canopy. This stand had also *Vibernum grandiflorum, Sarcococa saligna* species like previous stands. *Desmodium elegans,* a new species was introduced in the stand. In herbaceous layer, *Verbascum thapsis, Geranium* and *Androsac rotundifolia* were also newly introduced species.

The community developed in the Saidano area whose soil temperature was 22 C^0 and soil color was black. The community established at 40 C^0 and had occupied north facing aspect of the mountain. The habitat was moist.

Air temperature was 75.2 F^0 and had 740 µM/mΛ2S. Leaf wetness was 15 and habitat was moist. Habitat received 740 Wat/m^2solar radiations. Humidity in the air was 65.1% and air with 24 mph speed was blowing at 63^0 in west to east direction (Table 5.1.3).

Biological spectrum showed that hemicryptophytes were dominant life form class (spp., 4= 25%) followed by nanophanerophytes (spp., 3=18.75). In leaf form spectrum, microphyll (spp., 6=37.5%) followed by mesophyll (spp., 5=31.2%) and leptophyll (spp., 4=25%) were leading classes.

4. *Vibernum – Pinus – Cannabis* Community (VBC)

The fourth community was developed at elevation of 2350m on north facing slope (45^0) of the hill. The habitat was moist with black color of soil whose temperature was 23 C^0. A total of 15 plant species were recorded in the community , included 9 herbs, one species of shrub and 5 species of tree. The shrubby layer had the only *Vibernum grandiflorum.* Dominant members of the community *Pinus wallichiana* ((IV = 116.5), *Cannabis sativa* ((IV = 99.2) and *Juglan regia* ((IV = 81.4). In tree layer, 39 individuals were recorded for *Pinus wallichiana* and only 4 trees of *Juglan regia* were present. In herbaceous layer, most species were recorded for *Cannabis sativa* followed by *Bromus japonica* and *Gerardiana palmata.*

This location was called Garang located at 2350m. Air temperature was 72.6 F^0. PAR light calculated was 1040 µM/mΛ2S, and leaf wetness was 14. Solar radiation received by the stand was 940 Wat/m^2. The relative humidity was 64.7% and wind was blowing in east direction with 10mph at 31^0 (Table 2.5). Generally the soil temperature was due to the low cover.

In biological spectrum, therophytes were the dominant life form class (spp., 4 =27%) followed chameophytes and mesophanerophytes (spp., 3=20%), each had the same percentage.

In leaf form spectrum, msophyll, microphyll and leptophyll were dominant classes of the spectrum.

5. *Pinus – Plectranthus – Berberis* Community (PPB)

In top hill vegetation the dominant members of the community were *Pinus wallichiana, Plectranthus rogusus* and *Berberis lyceum.* This community was found at 2475m elevation. A total of 6 plant species were recorded composed of 3 shrubby members and three tree species. *Pinus wallichina* was dominant species with ((IV = 245). In shrubby layer *Plectranthus* ((IV = 181) and *Berberis* ((IV = 94) were dominant members of the community. This community had developed on eastern facing slope (52^0) with 21 C^0 soil temperature. The soil color was brown and habitat was moist. A strong wind was blowing from west to east direction.

This stand is located at Top of Garang and at elevation of 2475m. The air temperature recorded was 70.5 F^0, PAR light in the stand was 645 µM/mΛ2S and leaf wetness (LW) was 14, indicating cool moist conditions of the habitat. The Ganrang top received total radiation 1105 Wat/m2 with relative humidity 58.1 % and wind speed was 44 mph (Table 2.5).

In biological spectrum chameophytes and microphanerophytes were dominant classes in life form and microphyll and leptophyll were dominant leaf size classes.

Summer Season

1. ***Pinus – Sarcococa – Aristida* Community (PSA)**

In summer season, the same number of stands were tried to study for vegetation analysis. A total of 26 plant species were recorded in the area comprised of 18 herbs, 6 shrubs and 2 trees. The dominant plant species were *Pinus wallichiana* (IV = 248.1) in tree layer, *Sarcococa saligna* (IV = 106) *Aristida depressa* (IV = 94.4). *Quercus dilatata* (IV = 51.9) was an associated member in tree layer. The important species in shrub layer were *Andrachne cordifolia* (IV = 55.4), *Vibernum grandiflorum* (IV = 54.7) and *Desmodium elegans* (IV = 45.7). Ground layer comprised of herbaceous plants had high diversity in this season.

Biological spectrum showed that therophytes (spp., 12=46.2%) were leading class of life form, followed by phanerophytes (spp., 8 = 30.8%) and cryptophytes (spp., 6=23.1%). In leaf form spectrum, macrophyllous (spp., 13=50%) leaves were dominant followed by mesophyll (spp., 8=30.8%) and nanophyll (spp., 5=19.2%).

2. ***Pinus – Indigofera – Plectranthus* Community (PIP)**

This community was present at 6890 ft elevation on west facing slope of 55^0. The habitat was moist. A total of 21 plant species were recorded in which 18 species were herbs, 2 were shrubs and had a tree. *Pinus wallichiana* was the only representative of tree layer and it dominated the whole stand. It was an emergent species. *Indigofera hetrantha* (IV=153) followed by *Plectranthus rugosus* (IV=147) were representative of shrubby layer. In summer season, monsoon rains are abundant and it had pleasant affect on the diversity of vegetation. Herbaceous layer was rich in diversity but it was only limited to ground floor. *Dactylis glomerata* (IV=88.8) was the dominant grass in the layer.

Therophytes were the dominant class of the biological spectrum (spp., 8=38.1%) followed by hemicryptophytes (spp., 6=28.6%) and cryptophytes

(spp.,4=19%). Leaf form spectrum showed that microphyll (spp., 9=42.9%), followed by nanophyll (spp., 7=33.3%).

3. *Pinus – Bromus – Berberis* Community (PBB)

The PBB community (*Pinus –Bromus - Berberis*) developed at 7300ft asl. This community was dominated by *Pinus wallichiana* (IV=248.7) in tree layer, *Bromus japonica* (IV=109.9) in herbaceous layer and *Berberis lyceum* (IV=108.1) in shrubby layer. The other tree member is *Quercus dilatata* (IV=51.3). Other members of the shrubby layer were *Desmodium elegans* ((IV= 36.4), *Indigofera hetrantha* (IV=63.9) and *Plectranthus rogusus* (IV=91.6). *Stachys serica* (IV=107.2) was an important herbaceous plant. Total of 15 plants had been reported in which 9 species were herbs, 4 were shrubs and 2 were trees.

Qualitative analysis of biological spectrum indicated that therophytes (spp., 5=33.3%) followed by nanophanerophytes (spp., 5=33.3%) were dominant life form classes. In leaf form spectrum, microphyll (spp., 6=40%) followed by nanophyll (spp., 5=33.3%).

4. *Vibernum – Cynodon – Pinus* Community (VCP)

This community was developed at elevation of 7700 ft on north facing slope at (45^0) of the hill. A total of 18 plant species were recorded in the community, included 12 herbs, 2 species of shrub and 4 species of tree. The dominant species of the stand were *Vibernum grandiflorum* (IV=167.3), *Cynodon dactylon* (IV=147.4) and *Pinus wallichiana* (IV=138.2). Other associated species in the stand included *Juglan regia* (IV=67.4), *Piecea smithiana* (IV=33.2) and *Abies pindrow* (IV=61.2) in tree layer while shrubby layer comprised of *Plectranthus* and *Vibernum* species. In herbaceous layer no grass or forbs had earned high importance value than 23. It means that herbaceous layer contributed to stratification of vegetation but is not so important.

The qualitative analysis of biological spectrum indicated that therophytic vegetation (spp., 6=33.3%) dominated followed by cryptophytes (spp., 3=16.7%) and mesophanerophytes. In leaf form analysis, microphyll (spp., 9=50.3%) followed by leptophyll (spp., 5=27.3%) were the dominant classes.

5. *Pinus – Indigofera – Impatiens* Community (PII)

This community was established at elevation of 8100 ft on top hill. Dominant members of the community were *Pinus wallichiana, Indigofera hetrantha* and *Impatiens balsiminea.* This community was supported of 21 plant species comprised of 4 shrubby members and 5 tree species and 12 herbaceous species. The dominant members were *Pinus wallichiana* (IV=130.5), *Indigofera hetrantha* (IV=100.4) and *Impatiens balsiminea* (IV=100.1). Each member from each stratum was represented by high importance value. It indicated that stratification was complete and community was mixed and mature. The tree layer had trees like *Juglan regia, Picea smithiana, Abies pindrow* and *Pinus gerardiana* were started as the altitude increases.

The qualitative assessment of life form classes revealed that therophytes (spp., 5=23.8 %) followed by cryptophytes (spp., 5=23.8 %), microphanerophytes (spp., 4=19.0 %) were dominant classes. Microphyll (spp., 10=47.6 %) followed by nanophyll (spp., 5=23.8 %) were most representative classes of leaf form spectrum.

Winter season

Winter season is very lengthy and starts from September and last till to the commencement of April. It is completely a dormant season in the site. Most parts were covered with snow and only tree species and shrubs were represented the vegetation.

1. *Pinus – Parthenium – Plectranthus* Community (PPP)

This community developed in the foot hill vegetation where temperature was not so much down as the mid hill stands. Dominant members of the community were *Pinus wallichiana, Plectranthus rugosus, Rubus fruiticosus, Rosa macrophylla, Indigofera hetrantha, Berberis kunawarensis, Rumex hastatus* and *Parthenium* Species.

In stand 2, 3, 4 and 5 had only tree and shrubby species that they were present. The site was look like a white sheet laid on the mountain. It was a scenic moment and was dangerous to climb.

Edaphic Characteristics

Physiochemical analysis of the soil showed that soil texture varied from sandy to loamy sand soil. Stand I had sandy soil which occupy the foot hill. It is perhaps due to the snow fall which melts and water carries along itself the clay, leave behind sand and pebbles. As elevation increases, the soil texture changed from sandy to

loamy sand soil. The soil is alkaline and its pH varied from 6.5 to 7.4. Electrical conductivity of the soil varied from 0.04 to 0.12. Stand I & II had same EC values. It is noted that EC value increased with altitude and then decreased in stand IV. Exchangeable Na % also increased with increase with increase in elevation. Stands I, II & III had similar values of exchangeable Na but IV & V had 0.3 & 0.4 respectively. Organic matter also increased with increase in altitude. Stand V had low organic matter i.e. 0.76. Similar situation existed for N % like organic matter. Stand IV had the highest N % than other communities. Phosphorus in soil varied from 4 % (stand I) to 12 % (stand IV). P % had also same trend of increasing contents along the altitudinal gradient. Exchangeable potassium recorded in soil ranged 30 % to 100%. Stand III & IV had same % of K content in soil.

Species Richness

The spring aspect supported 74 plant species. The site ranged from 6 smallest numbers of plants to the 20 largest numbers of plants. The species richness for stand I was 0.771, stand II 0.558 and for stand III 0.598. The stand I had highest species richness while stand II & III had same number of plants but species richness varied. Stand IV had low richness although had similar number of plants. Stand II & III were pruned to grazing and biotic interference. In summer aspect, a total of 107 plant species were recorded, in which 26 species were present in stand I and had 0.6 species richness. The stand II & III had 21 number of plant species but had 0.64 and 0.337 species richness. The stand IV had highest species richness 0.7. In winter aspect stand I & II had 0.585 and 0.293 richness respectively.

Index of Diversity and Equitability

Table 4 revealed that highest diversity was recorded for stand 1 and is 2.5. Its equitability was also high than other stands in spring aspect. It means that evenness was also high and species were evenly distributed. Stand II had also highest diversity after stand I and its equitability also was high. It is interesting to note that as elevation increases the diversity only this site decreases. The Table 4 showed this decreasing trend in diversity. The case is same for the distribution of the species. The equitability also decreased with increasing altitude.

The similar trend was found in summer season. Decreasing trend in diversity index with increasing height explains that environmental conditions become harsh as the site located at high altitude.

The similar behavior existed in winter season. In the first two stands diversity decreases and similarly equitability also.

The results revealed that as the diversity is high the equitability also which means that species were evenly distributed. Results of all three seasons indicated that summer season had the highest diversity and equitability.

Maturity Index

Table 4 depicted that the stand II had the highest MI (43.8%) in spring season and lowest was recorded for stand 1 i.e. 36%. Stand III had also high maturity index value but then the remaining stands had low values of maturity index. It is cleared that community II was more mature and complete than other stands.

In summer aspect, the stand V had low MI value than other stands. It was recorded highest 42.8 for stand IV. In winter aspect the similar trend existed between the stands.

Generally, the results represented that winter season had more mature communities than other seasons.

Constancy

Constancy values indicated that class II i.e. (20 – 40%) dominated stand one. Species found in stand I were seldom present. Stand II had also similar situation and class II represented 14 plant species. Only *Pinus wallichiana* and *Plectranthus rugosus* were found to occur in class 5 (80-100%). Equal distribution of different species were found in stand III and only two species, each in group IV & V were present. The species like *Artemisia dubia, Cannabis sativa, Plectranthus rugosus* and *Berberis lyceum* had high constancy values in spring season and they had also high ecological amplitude. These species had shown very low fidelity.

In summer season, *Aristida depressa* in stand I, *Brachiaria reptens, Dactylis glomerata* and *Gallium aparine* earned the highest constancy values and had high ecological amplitude. Similarly *Bromus japonica, Stachys serica, Cynodon dactylon* and *Impatiens balsiminea* were the leading plant species that had showed low fidelity.

Index of Similarity

In spring season, Table 4 showed that similarity index between stand I & II is high (76). It is present in group IV and had potential natural community. Similarly stand II & I, III & I, IV & I, III & II, IV & III were present in 51 – 75 % and showed similarity. They represented late stage of the succession and community is

somewhat more established and mature. The stand V & I, V & II, V & III, V & IV were ranged in 26 – 50 % similarity and are considered in mid stage of development.

In summer aspect, only V & IV were in late stage of the development. Remaing all were in either in early or mid stages. Their similarities were very low and cannot beyond the 50%.

In winter season only II & I were in late stage while rests of the communities were in early stages.

Degree of Homogeneity

Results in Table 5 revealed that frequency classes were not following the Raunkaier law of frequency for spring, summer and winter seasons. All stands in different seasons in Bakht Banda Hills were heterogeneous and no stand was homogeneous. So all stands were not correlated.

Regeneration Capacity

Regeneration is an important tool to dertermin age and population status of the community. Bakht Banda site is poor on the basis of tree richness. A total of 7 tree species were recorded in the spring season in the site. These all tree species were of considerable importance and had occupied an important position in the area. The site is famous for tree abundance because the Table 6 indicated that all age of trees were found. *Pinus wallichiana* had showed regeneration and exceeded to class V. *Picea smithiana* was second leading tree species in the site. *Ailanthus altissima, Juglan regia, Quercus dilatata* and *Quercus incana. Quercus* had few trees in the site.

In summer season, *Pinus wallichiana* exceeded class IV and all other tree species were also shown growth. The site had few settlements and is protected from human interference. That is why it showed mature ecosystem and had trees of various age group.

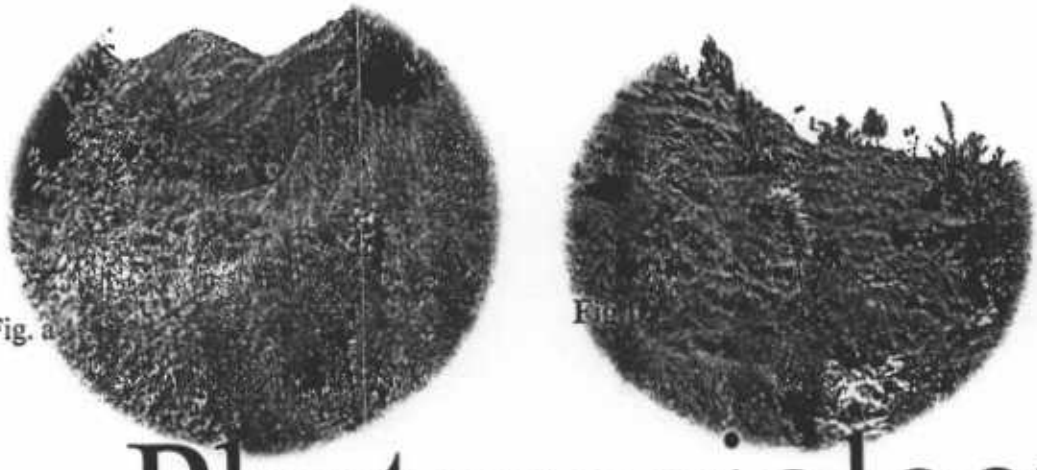


Fig. a

Phytosociology

Fig.5.1 Panoramic View of Dhali Hills,(a,b,c).

of Dhali Hills

(Site Five)



Dhali Hills

Dhali Hill located at east of the Chakesar valley and is a small mountain than other studied sites. The name is after a heap of mountain. Its height ranges from 4068 ft (1240m) to – 4300ft (1310m) asl. On the basis of vegetation structure, it was divided into three stands which were outlined as follows.

Spring Aspect

1. Punica – Ailanthus – Ficus **Community (PAF)**

This community was established at 4068 ft (1240m) asl. The dominant plant species on the basis of importance values were *Punica granatum* (IV= 190.2), *Ailanthus altissima* (IV= 158.1) and *Ficus palmate* (IV= 141.9). Other important species included *Cannabis sativa* (IV= 139.8), *Rubus ellipticus* (IV= 109.8) and *Artemisia dubia* (IV= 46.9). A total of 22 plant species were recorded in the stand composed of 18 herbs, 2 shrubs and 2 were included in tree layer. The total importance value of the herbs except the dominant species was 115. The soil temperature was 23 C^0 and slope was 35^0. It was south aspect of Dhali and habitat conditions were moist. Microphyll was the dominant leaf size class represented by (50 %) plants and therophytes were the leading dominant life form classes (68 %) while other classes made only 31.82 % (Table 5.1.1).

Environmental variables included air temperature (98.7 F^0), PAR light was 645 µM/mΛ2S and leaf wetness was 0. Leaf wetness measures the moisture in surrounding of plants. It was a measure of resistance of water. It indicated that stand was dry. The habitat received 1441 Wat / m^2 indicates that habitat received enough radiation sufficient for maximum productivity. Relative humidity was 62.4 % with wind 5mph speed at direction of 289^0.

2. *Indigofera – Pinus – Calendula* Community (IPC)

This community was established at 4183 ft (1275m) height and is locally called Seikary and was dominated by *Indigofera hetrantha* (IV= 206.7) in shrubby layer, *Pinus roxburghii* (IV= 116.6) at tree layer and *Calendula arvensis* (IV= 76.4) in herbaceous layer. The herbaceous layer is seemed to distribute evenly than any other layers. Other important plant species with respect to importance values were *Zanthoxylum armatum* (IV= 68.8), *Morus alba* (IV= 57.6) and *Cannabis sativa* (IV= 47.7). Soil temperature was 25 C^0 and soil color was white indicating higher content

of carbonates and salts of aluminum. This community was developed at 30^0 slopes on east aspect of the hill. The habitat was dried and strong wind was blowing (Table 5.1.2).

Air temperature was $98.5F^0$; photosynthetically active radiation (PAR light) was 735 µM/mΛ2S. Wavelength from 400 - 750 nm is PAR. Light above 750 nm is photosynthetically inactive. Green light is reflected and is not absorbed. It checks growth of plants. The site had scrubby forest and top canopy cover was absent. The light directly reached to the ground layer and lies below 750 nm which is very active. Leaf wetness was 1. Leaf wetness measures the moisture in surrounding of plants. It was a measure of resistance of water. The habitat received 938 Wat / m^2 indicates that habitat received enough radiation sufficient for maximum productivity and was dry. Relative humidity was 62.5 % with wind 5mph speed at direction of 272^0.

Community was supported by 19 plant species included 11 herbaceous plants, 3 were shrubs and 5 plant species constituted tree layer. Hemicryptophytes were dominating all the life form classes followed by therophytes and chameophytes. Microphyll had constituted dominant leaf size spectrum.

3. ***Pinus – Plectranthus – Poa* Community (PPP)**

This community was developed at 4300 ft (1310m) asl and was dominated by *Pinus roxburghii* (IV= 101.4) in tree layer, *Plectranthus rogusus* (IV= 83.6) in shrub layer and *Poa annua* (IV= 82.5) in herbaceous layer. *Sorghum hapalensis* was the second leading dominant member of herbaceous layer with (IV= 63.7). All other herbs had not exceeded IV = 24. Generally, all the accounted shrubs were important and had crossed IV =50 except *Sarcococa saligna* (IV = 38.1) which was confined to only shady habitat of the community. Cryptophytes (32 %) dominated the life form classes followed by therophytes (16 %) and nanophanerophytes (16 %). Soil temperature was $23C^0$ and existed at eastern slope of 45^0. Air temperature was $98.2\ F^0$ and had 845 µM/mΛ2S. Leaf wetness was 0 and habitat was dried. Habitat received 1524 Wat/m^2solar radiation. Humidity in the air was 61.3% and air with 10 mph speed was blowing at 286^0 in west to east direction (Table 5.1.3).

Summer Aspect

1. ***Berberis – Ailanthus – Pinus* Community (BAP)**

This community was developed at 1240m elevation on south facing slope with dried habitat. Dominant species on the basis of importance values were *Berberis lyceium* (IV=173) in shrubby layer, *Ailanthus altissima* (IV=131.5) and *Pinus roxburghii* (IV=78) in tree layer. All other plant species had not crossed importance value higher than 40. These plants were considered as emergent plant because these plant species made the upper storey of the vegetation. A total of 22 plant species were recorded in this stand of which 11 had made herbaceous layer, 5 had developed shrubby layer and 6 species constituted tree layer. Life form spectrum indicated that therophytic vegetation dominated the stand with 68.1% and showed xerophytic vegetation. Habitat is closed to the settlements and is open and directly received light and warm up in summer result in emergence of forbs and herbs. In leaf form spectrum, microphyll dominated. Generally vegetation was micro therophytic (Table 5.2.1).

2. ***Berberis – Indigofera – Cynodon dactylon* Community (BIC)**

This community developed and comprised of *Berberis lyceum* (IV =183), *Indigofera hetrantha* (IV = 72) and *Cynodon dactylon* (IV =58). Shrubby layer dominated in the vegetation. Total IV for herbs accounted 242. A total of 11 plant species were recorded consisted of 8 herbs and 3 shrubs. Hemicryptophytic vegetation was leading class with 31.5 % followed by therophytes (21.05 %) and chameophytes (21.05%). Microphyll was dominant class in leaf form followed by nanophyll (36.8%) (Table 5.2.2).

3. ***Berberis – Ailanthus – Pinus* Community (BAP)**

This community was established by *Berberis lyceum* (IV =217), *Ailanthus altissima* (IV = 101.2) and *Pinus roxburghii* (IV = 101.2). Other associated species included *Sorghum haplensis* (IV = 83.8), *Cenchrus ciliaris* ((IV = 62.8) and *Aristida cyanantha* ((IV = 41). The community was supported by 16 plant species comprised of 10 herbs, 4 shrubs and 2 species constituted tree layer. Tree layer account higher IV than herbaceous and shrubby layer. Tree layer was dominant and were emergent. Biological spectrum indicated that hemicryptophytes contributed 25%, followed by therophytes (18.7%) and cryptophytes (18.7%). Leaf size spectrum showed that

nanophyll was dominant (44%) followed by leptophylls (38%). Vegetation was therocryptophytic in this stand (Table 5.2.3).

Winter Aspect

1. ***Berberis – Ailanthus – Pinus* Community (BAP)**

This community was established by *Berberis lyceum* (IV =202), *Ailanthus altissima* (IV =130.4) and *Pinus roxburghii* (IV =92.4). Other associated species included *Setaria viridis* (IV = 42.5), *Cynodon dactylon* (IV =48.8) and *Asplenium* (IV =45.3). The community is made of 20 plant species consisted of 9 herbs, 5 shrubs and 6 species were tree. The herbaceous layer had important species that had high importance values than other layers. The spectrum explained that therophytes dominated the stand (30%) followed by nanophanerophytes (25%) and microphanerophytes (20%). Microphyll (75%) was dominant leaf size class followed by leptophyll (25%) (Table 5.3.1).

2. ***Berberis – Cynodon – Tagetes* Community (BCT)**

This is a short community comprised of only 5 species consisted of 3 herbs and 2 shrubs. The important members of the community with highest importance values included *Berberis lyseum* (IV =229.7) followed by *Cynodon dactylon* (IV =112.6) and *Tagetes erecta* (100.9). Other two important species were *Fragaria vesica* (IV =86.4) and *Indigofera hetrantha* (IV =70.3). Therophytes contributed 40 % and leptophyll also shared the same percentage (Table 5.3.2).

3. ***Berberis – Pinus – Cenchrus* Community (BPC)**

BPC (*Berberis – Pinus – Cenchrus*) community supported 10 plant species included 4 herbs, 4 shrubs and 2 trees. The dominant species were *Berberis lyceum* (IV = 217), *Pinus roxburghii* (IV = 161.1) and *Cenchrus ciliaris* (IV = 157.5). Other important species were *Ailanthus altissima* (IV = 138), *Cynodon dactylon* (IV = 59) and *Tagetes erecta* (IV = 43.5). This site has very low diversity due to drought and chill. Biological spectrum indicated that all life form classes were found equally and nanophyll dominated leaf size classes (Table 5.3.3).

Edaphic Characteristics

Physiochemical analysis of the soil indicated that soil texture varied from sandy loam to sandy clayey loam soil. Stand II & III had sandy loam soil. The soil is acidic and its pH varied from 5 to 6.9. Electrical conductivity of the soil varied from

0.06 to 0.53. Community PAF and IPC had 0.06 EC values and PPP had 0.53. Exchangeable Na % was high in stand 0.5 and stand II and III had lower values. Organic matter was high in stand III while it was low in I & II. Stand I had low N % (0.023 %) while stand III (0.094 %) had high values. Phosphorus in soil varied from 7 % (stand I) to 32 % (stand II). Exchangeable potassium recorded in soil was 130 % each in stand I and stand II and stand 3 had 160 % (Table 2.4).

Species Richness

The spring aspect supported 66 plant species in Dhali hill. The site ranged from 19 smallest numbers of plants to the 25 largest numbers of plants reported. The species richness for stand I was 0.74, stand II 0.454 and for stand III 0.81. It seemed that the mid hill had low species richness than foot hill and top hill stands. This stand was pruned to severe grazing pressure. In summer aspect, the high richness was noted in stand 1 which had 0.86 followed by stand III with 0.675 and low species richness was recorded for stand II. It is evident that similar trend was followed by vegetation in summer aspect as spring season. The same behavior was also noted for winter aspect. The stand I and stand III had high richness than stand II.

However, the trend of species richness was decreasing from spring to winter through summer. Perhaps it is due to easy accessibility of the site to the settlements. Degradation in habitat, structure of vegetation was high (Table 2.6).

Index of Diversity and Equitability

It is helpful in species commonness. Results of spring season showed that diversity of stand II was high although its species richness is low. It means that evenness is high. Similarly equitability was also high. So the species were evenly distributed along the stand than other stands. The stand II had also high diversity index with high equitability. In this stand the species richness was high. In stand I, S values were moderate but diversity was low as its evenness was also minimum. The plant species in stand I were not uniformly distributed.

In summer aspect, the highest diversity was recorded for stand II followed by stand I and stand III. Equitability of stand III was high followed by stand II and stand I. In winter season, stand I had also high diversity and equitability indices. The stand I had plant species which were have high species richness and evenness followed by stand II.

Study of the three aspects of the year indicated that summer had generally high species diversity and also its distribution. The low diversity was recorded for

winter season. Among all seasons and stands of the Dhali site highest diversity and species evenness was recorded in summer (Table 2.6).

Maturity Index

Table 3 depicted that stand II in winter aspect showed more maturity followed by stand II in summer season. The average values of each season indicated that maturity of the stands increases with time. The lowest average of maturity index was calculated for spring season (30 %) followed by summer (44 %) and winter season (49 %) showed mature plant communities (Table 2.6).

Constancy

Constancy values of spring aspect of Dhali showed that stand I had 19 species that occurred in class I i.e. 1 – 20 %. Only 2 species were often present. Stand II had also 8 species rare, 3 were seldom present, 4 were often present and 4 were mostly present. Stand III had mostly species belonged to class II of constancy table. In spring season, mostly species were rare. In summer season, Dhali had dominant class II of constancy table. Generally, the summer season showed high constancy values, indicated that species had high ecological amplitude and low fidelity. Winter season represented species mostly in class I and class II. Only 3 plant species had high ecological amplitude and low fidelity.

Index of Similarity

Disturbances were more in the Dhali than other sites. On the basis of succession of communities, all studied sites in Dhali showed early stages except stand III and II that were late in succession of development. Similarity percentages were very low and their resemblance was negligible in all studied stands in all seasons. Only in winter season, stand II showed 53 % similarity with stand III (Table 2.7).

Degree of Homogeneity

Results in Table 5 revealed that frequency classes were not following the Raunkaier law of frequency for spring, summer and winter seasons. All stands in different seasons in Dhali were heterogeneous and no stand was homogeneous. So all stands were not correlated (Table 2.8).

Regeneration Capacity

Age and population status of the community was determined by regeneration capacity. A total of 11 tree species were recorded in the spring season in Dhali Hill, Chakesar. Out of these trees only 6 trees crossed class II and remaining species were

short stature and were under stress. *Pinus roxburghii* had showed regeneration and exceeded to class V. *Salix tetrasperma, Melia azadarichta* and *Morus alba* showed good regeneration. In summer season, *Pinus roxburghii* did not exceed class IV and all other tree species were in class II. It indicated that stress was very high and pronounced in the area and it had stop growth of the plants. Results revealed that tree species in winter season, had showed some advancement (Table 2.9).

Dhali hill is located in east of the Chakesar valley about 1350m asl. The area was struck by devastated earth quake in 2005 that damaged each and every facet of life. It had raised highest death toll in history of Pakistan. The valley was also suffered and it had experienced many casualties. The vegetation was also suffered and cattle, sheep and goats were also become victims. The climate changed in last few years. Rainfall reduced that altered vegetation structure and species composition. Environmental conditions in the studied sites were harsh and soil condition was poor.

During the study in spring season, a total of 66 plant species were identified, 49 plant species were recorded in summer season and 35 plant species noted in winter season. The communities were disturbed and stratification was very poor. It determines the environmental conditions. Naqvi (1974), Beg (1978) and Hussain & Tajal malook (1984) had also observed similar characteristics of vegetation as reported by Chaughtai &Yousaf (1976). Three communities were identified in spring aspect. Dominant plant species were *Punica granatum-Ailanthus altissima – Ficus palmate* and had occupied foot hill of the Dhali. *Ailanthus altissima* spread through whole site and had replaced the tree layer in natural vegetation. *Cannabis sativa* also an exotic species dominated the stand. The communities characteristic were described in Table 2.1.1, to 2.3.3. Other two communities were *Indigofera – Pinus – Calendula* Community (IPC) and *Pinus – Plectranthus – Poa* Community (PPP). In summer season, communities that were established are *Berberis – Ailanthus – Pinus* Community (BAP), *Berberis – Indigofera – Cynodon dactylon* Community (BIC) and *Berberis – Ailanthus – Pinus* Community (BAP) while winter season had *Berberis – Ailanthus – Pinus* Community (BAP), *Berberis – Cynodon – Tagetes* Community (BCT) and *Berberis – Pinus – Cenchrus* Community (BPC).

Qualitative study of biological spectrum indicated that spring season in stand I had microphyll and therophytes; stand II had hemicrypto therophytic vegetation with microphyll dominant leaf form class and stand III had also crypto therophytic vegetation. Therophytes with microphyll form were mostly prevailing classes in

spring season. Occurrence of therophytes and microphyll indicated disturbed habitats and harsh environmental conditions. Ajaib *et al.*(2008) had studied biological spectra of Saney Baney hill District Kotli Azad Jammu & Kashmir. In summer aspect, mostly dominant life and leaf form classes were thero and cryptophytes, and microphyll classes. Similarly winter season had also dominant microphyll and leptophyll leaf form classes. In biological spectrum therophytes and hemicryptophytes were leading classes. Cain & Castro (1959) described that it represent climatic conditions of a habitat. Qadir & Shetvi compared communities with qualitative spectrum and had similar results. Malik & Hussain (1987) had also similar findings.

The soil of the site was soft and good for germination of seeds. Its texture was sandy loam to sandy clayey loam. It was not hard and blocky. Although, clayey content make it hard in some habitat. pH was less than 7 and higher than 5. It was relatively acidic and best for optimum production of crops. EC values were less than 2 which in further indicated good soil. Exc. Na content was low and it should be less than 1.0 mg/100g. Enough K and P contents were found (Table 2.4).

During study periods, the site had good exposition and receiving enough radiations with avg. of 60 % relative humidity. Its temperature was high and was warm than other sites (Table 2.5).

Spring season had high species richness than other seasons. It had 66 plant species with 0.81 in stand III at 1310m altitude. Summer season produced 49 plant species with 3.95 highest in stand II. Ecological factors such as temperature, water, light and degree of patchiness can be used as future predictor for species richness and its distribution. Physiognomy, slope, aspect, radiation, habitat structure are all important in determining plant species richness.

Diversity of stand II was high while its species richness low. Its equitability also high. Diversity in spring and winter was low due to precipitation. Summer season received high amount of precipitation and this has caused to germinate more plant species (Table 2.6). Diversity up to certain altitude increase. It was also shown by Hussain *et al.*(1994) that diversity of plant species increase from low altitude to high altitude. Gokbulak (1999) stated that grazed land had more diversity than ungrazed land. Dasti & Malik (2000) described association between landscape and environmental factors. Malik (2001) stated that summer had diversity due to precipitation. Awan *et al.*(2001) also described high diversity of such plants in summer season. Nai Bregaglio *et al.* (2002) studied effect of grazing on floristic

composition and diversity. Van Rujaven & Berende (2003) studied effect of species richness in productivity. Solomon *et al.* (2007) studied soil quality and diversity.

Table 2.6 depicted maturity index and it is quotient of the total of frequency % of all the species in a community, a total which Raunkiaer called points, divided by the number of species found on the station (Pichi-Sermolli, 1948). It varied between 0 – 100 and community is said to more highly develop will have values near to 100. Whenever, value of maturity index low, vegetation shows immaturity. Maturity of the stands showed that summer communities had higher % of maturity than other seasons. Stand II in winter aspect had 74 % maturity followed by summer aspect had 62.7 % maturity.

Constancy values indicated that number of mostly present species were 4. Most of the species either stretch out in class I or class II of the constancy. They often or seldom present and thus species showed high degree of fidelity. These species occurred in narrow range of amplitude. In summer season, species extended to various habitats and had broader value and showed high ecological amplitude. Winter species showed high fidelity. It is evident that species occurrence are also influenced by seasonal variations.

Results in Table 2.7 ad 2.8 revealed that most of the stands were heterogeneous and had showed low homogeneity in all stands in different aspect of the year. The conditions explained high degree of disturbances and biotic interferences. Regeneration and carrying capacity revealed that stand III on top of the hill is protected by the local inhabitants as they owned it and had sapling of *Pinus roxberghii. Salix, Melia and Morus* species showed regeneration while it was hampered in all other trees (Table 2.9).

DCA Analysis of Vegetation

Detrended correspondence analysis (DCA) was used to further classify and confirmed the species in the community. TWINSPAN was also used to verify the results of ordination. In fig. 5.4, each point with letters words corresponded to species and its distribution. Different species occurring with same abundance in the same stands. The distance between points showed distribution of species (Ahmad & Yasin, 2011). In the fig 5.4, 9 stands of different seasons were considered, representing 33 plant species at all. Three plant association were constructed by plants i.e. group I, II & III. Group I had *Apluda, Daphne oloide, Sarcococa saligna, Oxalis corniculata, Adiantum* and *Euphorbia hirta.* Group II included *Sorghum*

hepalensis, Cynodon dactylon, Berberis lyceum, Indigofera hetrantha, Tagetes erecta and *Fragaria visica.* Most dominant plants in group III were *Cannabis sativa, Conyza aegyptica, Cyperus rotundus, Ailanthus altissima* and *Crysopogon aucheri.*

The study area had sparse and steady vegetation which were occurred in patches. There is a relation between species and environmental factors and similarly between resources available (Whittakar, 1956; Ahmad *et al.*, 2009; Jabeen & Ahmad 2009 and Ahmad & Yasin, 2011). El-Ghanim *et al.* (2010) studied vegetation at North of Central Saudi Arabia where TWINSPAN resulted 7 groups of vegetation. Ahmad *et al.* (2010) analyzed vegetation by using multivariate techniques. They used TWINSPAN and identified 16 communities. They also confirmed communities by DCA ordination programme. In worse conditions of the habitat, leaves become smaller and thorns become larger. TWINSPAN and DCA analysis showed that *Andropogon spp.* forming community in association with other species like *Sausseria* which typically grow in arid and harsh climate.

4.5. Degree of Palatability

Palatability refers to the relish with which feed is consumed as stimulated by sensory impulses (Heath *et al.,* 1985). Besides forest wood, the major utility of plants was fodder. The locals depend on livestock for their livelihood. As such major bulk of plants is grazed. Of the total 319 plants species, 197 (61.8%) species were palatable to various degrees (Table 4.6, Fig. 4.6). It included 50% herbs, 13.3 % shrubs and 36.7% trees. Based on taxanomic grouping there were 7.8 % monocotyledons, 52.7 % dicotyledons 0.9 % was gymnosperms and 0.3 % pteridophyta. The 86 (27.3 %) nonpalatable species included 23.5 % dicotyledons, 2.2 % pteridophyta, 0.6 % gymnosperm and 0.6 % monocotyledons. The individual contribution of each group to the total palatable species was 12.5% pteridophyta, 60% gymnosperms, 89.3% monocotyledons and 60.4% dicotyledons. Among the palatable species there were 32.0% highly palatable, which comprised species in the flora. Among the highly palatble 86.3% herbs, 3.9% shrubs and 9.8% trees. The less palatable species had 26% contribution, which included 47 % herbs, 26 % shrubs and 18% trees.

The results indicated that highly palatable species included *Convolvulus arvensis, Conyza bonariansis, Conyza aegyptiaca, Fumaria indica, Lathyrus aphaca, Aristida cyanantha, Aristida depressa, Avena sativa, Brachiaria reptens, Bromus japonica, Bromus tectorum, Cenchrus ciliaris, Chrysopogon aucheri, Cynodon dactylon, Dactylis glomerata, Dichanthium annulatum, Eragrostis japonica, Pennisetum orientale, Poa annua, Sorghum nephalensis, Sorghum nitidum, Themeda anathera, Triticum aestivum* and *Zea mays.* Some of them were marginal grasses and were available at high elevation. A number of rangelands are scattered with in the area that is source of dairy income. Hussain & Durrani (2009) observed the seasonal availability of forage, palatability and preferences of goats and sheep varied in their botanical composition throughout the growing season. They investigated 129 palatable species included high palatable, mostly palatable, less palatable and rarely palatable species. We also recorded 197 palatable species including 102 were highly palatable and 81 species were less palatable. Rahim *et al.* (2008) described that land grasses are suitable for feeding to livestock with some supplementation for different levels of production and classes of livestock. It is noted that people preferred to feed their cattles from land grasses. Bano *et al.*(2009) suggested that heavy but short term grazing of very long protected grasslands after substantial rainfall may be one strategy to increase palatability and animal nutrition.

The range lands support 30 million herds of livestock, which contribute US $ 400 million to Pakistan's annual export earnings (Anon., 2006). Since last two decades the pastures in the area were converted into croplands and had reduced the livestock production due to improper management. Once the area was famous for domestic Desi Gee, pure milk and yogurt but now these people entirely rely on the synthetic dairy products. This has also caused decrease of manure and increased use of commercial fertilizer, which in turn produces low quality fruits and vegetables.

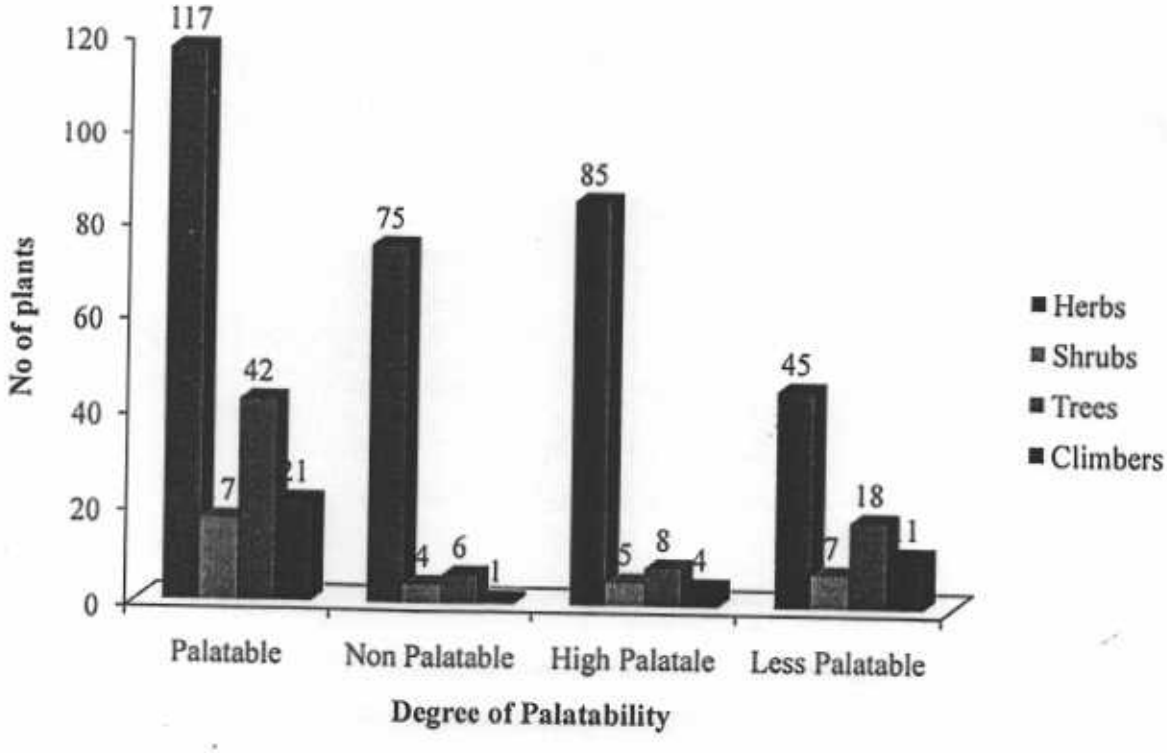
In the northern part of Pakistan, livestock contributes nearly 55 % to the gross provincial income by agriculture sector. The hilly areas (73%) of the province mostly has small lands for agriculture, hence, dependence on livestock is relatively high, particularly for rural subsistence. To match the maintenance requirements of livestock, there is a need of 13.5 and 110.3 million tons of crude protein and total digestible nutrients. (Rahim *et al.*, 2008). Most of the above mentioned grasses are harvested and stored as hay or grazed freely by the livestock. Rahim *et al.* (2008) described that these plants can be grouped on the basis of rangeland. We found that *Cenchrus ciliaris* and *Chrysopogon aucheri* were the most common grasses along field boundaries and margins of the heaps (Hussain & Durrani, 2007; Khan *et al.*, 2007; Sultan *et al.*, 2007; Sultan *et al.*, 2008; Rahim *et al.*, 2008).

Cynodon dactylon is a marginal perennial grass which has higher potential intake rate (PIR) than relative preference (RP). It is due to the presence of essential oil called piperitone that make it less palatable. This oil is responsible for a peculiar smell and taste of the grass (Rehman, 1995). This is perennial grass is available in all the seasons. Irrespective of the above stated statement, it is highly palatable to all livestock, sheep and goat. It is a rigid grass than other and therefore it is not preferred in presence of other grasses. The defense structures of plants decrease palatability. It also decrease rate of decomposition and remain intact after plant death. It is the nitrogen content in plants that increase plant attractiveness for herbivores (Palkova & Leps, 2008). Selective grazing replaces palatable grasses by unpalatable grasses. Moretto & Distel (1997) had opinioned that competitive ability of palatable species is higher than unpalatable species in absence of grazing.

Animal preference refers to selection of a plant species by animals as a feed. Some factors like forage species, age, and stage of pregnancy, general health and hunger of animals affect prefere. The plant characteristics comprise seasonal availability, degree of maturity, growth stage, phenology, morphological and

chemical nature, relative abundance and climate. These all factors influence palatability (Wahid, 1990; Kababia *et al.*, 1992; Nyamangan & Ndlovu, 1995, Hussain & Durrani, 2009). It has been observed that the preferences of livestock not only among themselves but it also changeswith their requirement, availability of forage and seasonal changes in the growth form of forage. Animals are, sometimes, compelled to graze on even non palatable species in the absence of preferred forage.

Fig. 4.6. Palatability of plants of Chakesar Valley, District Shangla

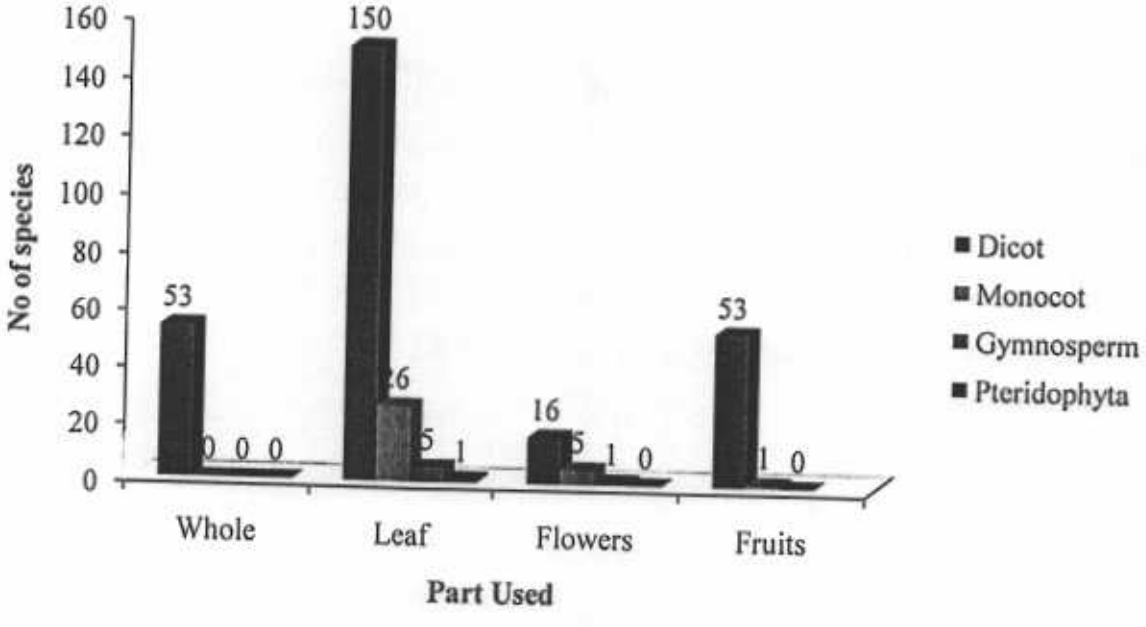


4.6. Palatability by Parts Grazed

Different parts of the plant have differential palatability according to the need and preference of grazing animals, chemistry, nutritive values of plant part, softness and attractivity of plant parts. Same species may be differentially grazed with respect to its parts. In the present study it was observed that in 53 (16.6%) species whole plants were grazed by cattle, sheep and goat. Whole herbaceous plant species were grazed by 100 % livestock. Whole shrubs and trees are grazed. Leaves were grazed in 182 (57.1%) species. Plants in which leaves were grazed included 180 (76.3%) herbs, 21 (8.9%) shrubs and 35 (14.8%) tree species. Flowers make only 5 % of the graze. It included 21 (84%) herbaceous, 4 (16%) shrubby species. Fruits of 53 (16.6%) species were used. In 76 (23.8%) species utilized by livestock. It included 42 (55.3%) herb, 12 (15.8%) shrubs and 22 (28.9%) tree species (Table 4.6; Fig. 4.7). Hussain & Durrani (2009) observed that 99 species were used as whole, in 30 species leaves and in 29 species floral parts were utilized.

Herbivory enhances plant diversity qualitatively in two different ways. i.e. global frequency abundance (occurrence of a species related to herbivory) and spatial variability (levels of herbivory can create ephemeral, local refuges for herbivory for each plant species). Both these mechanisms operate only if there is no negative correlation between plant palatability and its competitive ability. If there is no relation then plant diversity is increasing function of herbivores degree of monophagy (Pacala & Crawley, 1992). Sufficient forage quantity is necessary to supply essential nutrients herbivores. Proper grazing is essential to maintain adequate forage conditions. Younger tissues were more drought hardy than older tissues. Younger tissues also grew longer with subsequent wilting as water moved from old to young tissues. Wilted tissues had increased sugar contents and are highly palatable due to conversion of starch to sugar (Anderson & Scherzinger, 2001). Plant vigor is maintained only half the plant is grazed. Clark *et al.* (1998) suggested that one complete year of rest restores the losses of plant vigors.

Fig. 4.7. Palatability by part used of plants of Chakesar Valley, District Shangla.



4.6. Palatability based on freshness

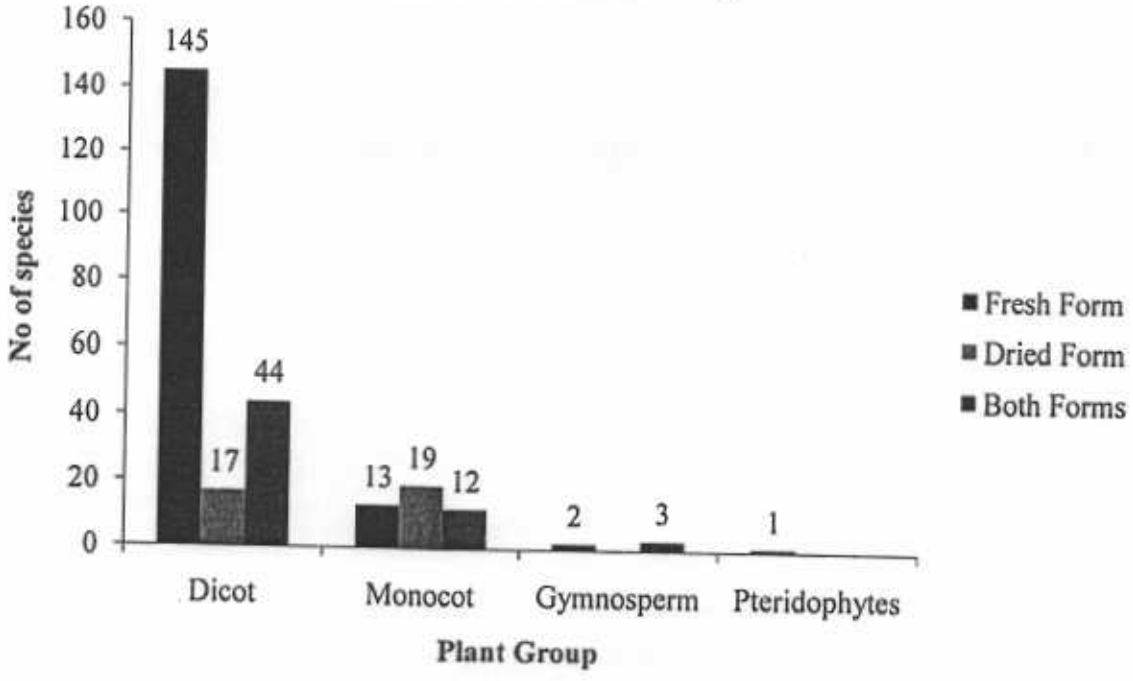
The review shows that no work on the availability, palatability, part used and animal preference of forage plants in Chakesar valley was carried out previously. Keeping in view the importance of the area, it was considered to study the palatability, forage preference by animals and part used. It is suggested to focus concentration on the forage plants of area to improve its availability and utilization.

Livestock utilized 161 (50.5 %) species in fresh condition, which consisted of 141 (71.6%) herbs, 20 (10.2%) shrubs and 36 (18.3%) trees. Thirty six (11.3%) species are used in dried form including 27 (67.5%) herbs, 10 (25%) shrubs. Among plants used in fresh condition, there were 17 (6.1%) dicotyledons and 19 (67.9%) monocotyledons. There were 66 (20.7%) species of plants that are used both in fresh and dried condition. These involve 44 (15.8%) dicotyledons and 19(67.9%) monocotyledons (Table 4.6; Fig. 4.8).

Goat, sheep and cattle usually opt for live fresh tissues. Grazing is important that it reduce the proportion of dead parts and increases the chances of availability and accessibility of live tissues of plants. The availability of fresh plant materials increases ungulate grazing efficiency.

Hussain & Durrani (2009) stated that seasonal availability of fodder species depend on phenological stages and climate. This is similar to our observation that if the climate is suitable, more fresh fodder species will be available to cattle. In drought and winter season dried species become the only source of food to the animals. In 2008- 09, low precipitation occurred in the valley which considerably declined the animal population. It produced shortage of dairy products and meat in the area. Hussain & Mustafa (1995) reported that most of forage species were used in fresh form by animals in Nasirabad valley (Hunza). Lichacar *et al.*(1996) said that shrubs provide fresh fodder in absence of annuals. It is evident that most of the fodder species available in July to September and forage production is high during this period.

Fig. 4.8. Palatability based on freshness of plants of Chakesar, District Shangla.



4.7. Palatability based on preference by animal type

Cattles seldom grazed steep slopes. They prefer to graze the flat plain and trample them. Trampling stress in the grazed area in rain or after rain. Few cows and buffalos can destroy an acre of area in a day. Contrary to the cattle, sheep and goat grazed steep slopes and also grazed on tree bark. At higher altitude, the people preferred to rear goat and sheep herds.

The results suggested that 28.8% cattles grazed on 86% herbs, 2.2% shrubs and 12% trees. The percentage of goat was greater than sheep in the valley. According to Anderson (1974) grazing animal's preferred shallow soil, burnt, poor site, drought affected and mature regrowth forage.

Hickman *et al.*, (2004) stated that animal diversity was a key variable influencing plant species diversity and its composition vegetation changes are also observed in moderately and lightly grazed rangeland.

Goats like all animals, express nutritional wisdom since they select plants of higher nutrient in pasture (Papachristou & Nastis, 1993). Buffaloes and cows grazed on 92 (28.8%) species. It included 79 (85.9%) herbs, 2 (2.2%) shrubs and 11 (12.0) trees. Goat grazed on 160 (50.2%) species and sheep on 156 (48.9%) (Table 4.6; Fig.4.9).

Grazing animal and human activities alter the grazing preference. Once a pasture is degraded, soil nutrient would be lost by mineralization and erosion (Wu & Tissen, 2002) which will decrease grassland productivity. Parizek *et al.* (2002) stated that soil erosion is the basic irreversible loss of soil productivity of most rangelands.

Goat generally preferred shrubs and sheep grasses in the present study. This agrees with other workers (Wilson. 1994; Hussain & Durrani, 2007, 2008). Rasool *et al.* (2005) stated that grazing system of Baluchistan involved 74 % nomads, 21 % transhumaniants and 5 % sedentary type. Omer *et al.* (2006) urged that forage production is high in spring in dry temperate forests in Northern area of Pakistan. Hussain & Durrani (2009) working on Harboi range land. They stated that goat consumed 98 species, included herbs, shrubs, grasses and tree. Our results agree with these previous studies.

Salgado *et al.* (2005) argued that at low latitude salt marsh plants are less palatable than high latitude. Similarly, Sasaki *et al.* (2005) analyzed the pattern of floristic composition under different grazing intensities in the semi arid area. They described that floristic composition were determined by grazing intensities together

with palatability. It is cleared from the present study that increases in grazing intensities decrease diversity. Grazing animal express their preference freely when there is abundance of forage plants.

with palatability. It is cleared from the present study that increases in grazing intensities decrease diversity. Grazing animal express their preference freely when there is abundance of forage plants.

Fig. 4.9. Palatability of plants by animal preference of Chakesar valley, District Shangla.

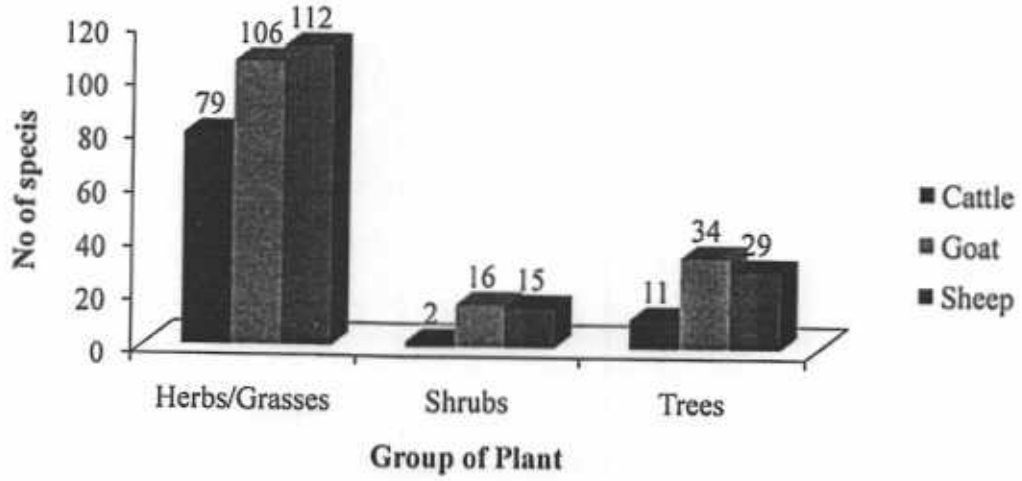


Fig. 4.9. Animal preference of plants of Chakesar Valley, District Shangla.

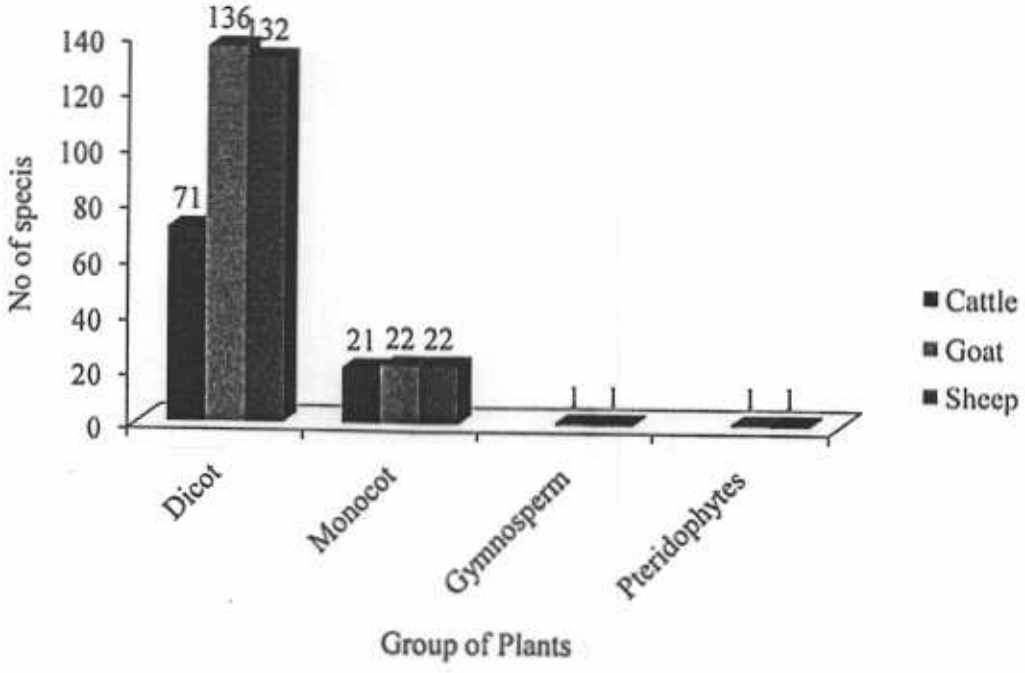


Table 4.2. Degree of palatability, animal preferences, parts used of plants of Chakesar Valley, District Shangla.

			Palatability				Part Used				Parts Used Condition			Livestocks		
S.No	Name of the Plants	Family	NP	P	*HP*	*LP*	W	L	Fl	Fr	Frsh.	D	B	C	G	S
Pteridophytes																
1	*Adiantum incisum* Forssk.	Adiantaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
2	*Marsilia quadrifolia* L.	Marsileaceae	-	+	-	-	-	+	-	-	+	-	-	-	+	+
3	*Pteridium eqilinium* L.	Pteridaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
4	*Aspidium* spp	Pteridaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
5	*Asplenium* spp	Pteridaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
6	*Davallia denticulata* (Burm. F.) Mett. Ex Kuhn	Pteridaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
7	*Pteris vitata* L.	Pteridaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
8	*Seliginella* spp.	Seliginaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub Total			7	1	0	0	0	1	0	0	1	0	0	0	1	1
Gymnosperms																
1	*Abies pindrow* Royle	Pinaceae	+	-	-	-	-	+	-	-	+	-	-	-	-	-
2	*Picea smithiana* (Wall.) Boiss.	Pinaceae	+	-	-	-	-	+	-	-	+	-	-	-	-	-
3	*Pinus gerardiana* Wall. Ex Lamb.	Pinaceae	-	+	-	+	-	+	-	-	-	-	+	-	+	+
4	*Pinus roxbughii* Sargent.	Pinaceae	-	+	-	+	-	+	-	-	-	-	+	-	-	-
5	*Pinus wallichiana* A. B. Jackson.	Pinaceae	-	+	-	+	-	+	-	-	-	-	+	-	-	-

Sub Total			2	3	0	3	0	5	0	0	2	0	3	0	1	1
Dicotyledons																
1	*Adhatoda vasica* Nees	Acanthaceae	-	+	-	-	-	+	-	-	+	-	-	-	+	-
2	*Barleria cristata* L.	Acanthaceae	-	+	-	-	-	+	-	-	+	-	-	+	-	-
3	*Dicliptra bupleuroides* Nees	Acanthaceae	-	+	-	-	-	+	-	-	+	-	-	+	+	+
4	*Dicliptra roxburghiana* Juss.	Acanthaceae	-	+	-	-	-	+	-	-	+	-	-	-	-	-
5	*Acer oblongum* Wallich ex DC.	Aceraceae	-	-	-	-	-	+	-	-	+	-	-	-	+	+
6	*Acorus calamus* Linn.	Acoraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
7	*Achyranthes aspera* L.	Amaranthaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
8	*Amaranthes spinosus* Linn.	Amaranthaceae	-	+	-	+	-	+	-	-	+	-	-	+	+	+
9	*Amaranthus caudatus* L.	Amaranthaceae	-	+	-	+	-	+	-	-	+	-	-	+	+	+
10	*Amaranthus viridis* L.	Amaranthaceae	-	+	-	-	+	+	-	-	+	-	-	+	+	+
11	*Narcisus poeticus* Linn.	Amaryllidaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
12	*Pisticia integrima* Stew ex. Brandis	Anacardiaceae	-	+	+	-	-	+	+	-	-	-	+	+	+	+
13	*Ammi visnaga* (L.) Lam.	Apiaceae	-	+	-	-	-	-	-	+	-	-	+	-	-	-
14	*Anethum graveolens* Linn.	Apiaceae	-	+	-	+	-	-	-	+	-	-	+	-	-	-
15	*Carum carvi* Linn.	Apiaceae	-	+	+	-	-	-	-	+	+	-	+	-	-	-
16	*Coriandrum sativum* Linn.	Apiaceae	-	+	+	-	-	+	-	+	+	-	+	+	+	+
17	*Foeniculum vulgare* Mill.	Apiaceae	-	+	-	+	-	-	-	+	+	-	+	-	-	-
18	*Pimpinella diversifolia* DC.	Apiaceae	-	-	-	+	-	+	-	-	+	-	+	-	-	-
19	*Arisaema flavum* (Forssk.) Schott.	Araceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-

20	*Arisaema utile* Hook. F, ex Schott.	Araceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
21	*Arisaema jacquemonti* Blume	Araceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
22	*Sauromatum venosum* (Aiton) Kunth	Araceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
23	*Hedra helix*L.	Araliaceae	-	+	-	-	-	+	-	-	-	-	+	+	+	+	
24	*Hedra nepalensis* K. Koch.	Araliaceae	-	+	-	-	-	+	-	-	-	-	+	-	-	-	
25	*Calotropis procera* (Ait.) Ait. F.	Asclepiadaceae	-	-	-	+	-	-	-	+	-	+	-	-	-	-	
26	*Ainsliaea aptera* DC.	Asteraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
27	*Artemisia dubia* Wall.	Asteraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
28	*Artemisia japonica* Thunb., Fl. Jap.	Asteraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
29	*Artemisia santilifolia*	Asteraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
30	*Artemisia scentonema*	Asteraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
31	*Artemisia scoparia* Waldst. & Kit.	Asteraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
32	*Artemisia vulgare*L.	Asteraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
33	*Calendula arvensis* Linn.	Asteraceae	-	-	-	+	-	-	+	-	+	-	-	-	-	-	
34	*Calendula officinalis* Linn.	Asteraceae	-	-	-	+	-	-	+	-	+	-	-	-	-	-	
35	*Chrysanthemum leucanthemum* L.	Asteraceae	-	-	-	+	-	-	+	-	+	-	-	-	-	-	
36	*Cichorum intybus* L.	Asteraceae	-	-	-	+	-	-	+	-	+	-	-	-	-	-	
37	*Cirsium wallichi* DC.	Asteraceae	-	-	-	+	-	-	+	-	+	-	-	+	+	+	
38	*Conyza bonariansis* (Linn.) Cronquist	Asteraceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+	

39	*Conyza egyptica* Ait.	Asteraceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
40	*Cousinia thomsoniiC. B. Clarke*	Asteraceae	-	+	-	-	-	+	-	-	+	-	-	-	-	-
41	*Eclipta alba* Hassk.	Asteraceae	-	+	+	-	-	+	-	-	+	-	-	-	+	+
42	*Gnaphalium hypoleucum* DC.	Asteraceae	-	-	+	-	-	+	-	-	+	-	-	-	-	-
43	*Inula grantioides* Boiss.	Asteraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
44	*Saussoria albescens* (DC)Sch. Bip	Asteraceae	-	+	-	-	-	+	-	-	+	-	-	-	-	-
45	*Senecio chrysanthemoides* DC.	Asteraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
46	*Seriphidium stanosephalum*	Asteraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
47	*Sonchus arvensis* (DC) Kirp.	Asteraceae	-	-	+	-	+	+	-	-	+	-	-	+	+	+
48	*Gerbera gossypina* (Royle) Beauv.	Asteraceae	-	-	+	-	-	+	-	-	+	-	-	-	-	-
49	*Tagetes erecta* Linn.	Asteraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
50	*Taraxicum officinalis* Weber	Asteraceae	-	+	+	-	-	-	+	-	+	-	-	+	+	+
51	*Xanthium strumarium* Linn	Asteraceae	-	+	-	-	-	+	-	-	+	-	-	-	-	-
52	*Cichorum intybus* L.	Asteraceae	-	-	+	-	-	+	+	-	+	-	-	-	+	+
53	*Imaptiens balsiminea* Linn.	Balsaminaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
54	*Impatiens edgeworthii* Hk. F.	Balsaminaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
55	*Impatiens gigantea* Egew.	Balsaminaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
56	*Impatiens parviflora* DC.	Balsaminaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
57	*Berberis kunawarensis* Royle.	Berberidaceae	-	+	-	-	-	+	-	-	-	-	+	-	+	+
58	*Berberis lycium* Royle.	Berberidaceae	-	+	-	-	-	+	-	-	-	-	+	-	+	+
59	*Alnus nitida* (Spach) Endl.	Betulaceae	-	+	+	-	-	+	-	-	-	-	+	-	+	+

60	*Arenebia benthamii (Wall.) I. M. Johnston*	Boraginaceae	-	+	+	-	-	+	-	-	+	-		-	-	-
61	*Heliotrophium ophioglossum*Stocks ex Boiss.	Boraginaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
62	*Trichodesma indica* (L.) R. Br.	Boraginaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
63	*Heliotropium strigosum* Willd.	Boraginaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
64	*Brassica compestris* Linn.	Brassicaceae	-	+	+	-	+	+	-	+	+	-	-	+	+	+
65	*Brassica napis* Linn.	Brassicaceae	-	+	+	-	+	+	-	+	+	-	-	+	+	+
66	*Brassica oleracea* Linn	Brassicaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
67	*Capsella bursapastoris* (L.) Medic.	Brassicaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
68	*Eruca sativa* Mill.	Brassicaceae	-	+	+	-	+	+	-	+	+	-	-	+	+	+
69	*Lepidium sativum* Linn.	Brassicaceae	-	+	+	-	+	-	-	+	+	-	-	-	+	+
70	*Nasturtium officinalis* Linn.	Brassicaceae	-	+	-	-	-	+	-	-	+	-	-	-	-	-
71	*Sisymbrium irio* Linn.	Brassicaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
72	*Sarcococca saligna* (D.Don) Muell.	Buxaceae	-	+	-	+	-	+	-	-	+	-	-	-	+	+
73	*Cannabis sativa* Linn.	Cannabaceae	+	-	-	-	-	+	-	-	-	-	-	-	-	-
74	*Vibernum grandiflorum* Wall. Ex DC.	Caprifoliaceae	-	+	-	-	-	+	-	+	+	-	-	-	+	+
75	*Ceratium glomeratum* Thulli	Carryophylaceae	-	+	+	-	-	+	-	-	+	-	-	-	+	+
76	*Dianthus angulatus* Royle.	Carryophylaceae	-	+	-	+	-	+	-	-	+	-	-	-	+	+
77	*Silene vulgaris* (Moench) Garcke	Carryophylaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+

78	*Diantus carryophyllus* Linn.	Carryophylaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	-
79	*Stellaria media* (L.) Vill.	Carryophylaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
80	*Silene conoide* Linn.	Carryophylaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	-
81	*Chenopodium album* Linn.	Chenopodiaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
82	*Chenopodium caudatus*	Chenopodiaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
83	*Chenopodium murale* Linn.	Chenopodiaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
84	*Commelina bengalensis* L.	Commelinaceae	-	+	+	-	+	+	-	-	+	-	-	+		-
85	*Convolulus arvensis* L.	Convolulaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
86	*Ipomea palmata* Forssk.	Convolulaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	-
87	*Ipomea purpura* (Linn.) Roxb.	Convolulaceae	-	+	-	+	-	+	-	-	+	-	-	-	+	+
88	*Citrullus vulgaris* (Thunb.) Matsum. & Nakai	Cucurbitaceae	-	+	-	+	-	-	-	+	+	-	-	-	-	-
89	*Cucumis sativus* Linn.	Cucurbitaceae	-	+	-	+	-	-	-	+	+	-	-	-	-	-
90	*Cucurbita maxima* Duch.	Cucurbitaceae	-	+	+	-	+	-	-	+	+	-	-	-	-	-
91	*Cucurbita pepo* Linn.	Cucurbitaceae	-	+	+	-	+	-	-	+	+	-	-	-	-	-
92	*Luffa acutangula* (Linn.) Roxb.	Cucurbitaceae	-	+	-	+	-	-	-	+	+	-	-	-	-	-
93	*Luffa aegyptica* Mill.	Cucurbitaceae	-	+	-	+	-	-	-	+	+	-	-	-	-	-
94	*Luffa cylindrica* (Linn.) Roem.	Cucurbitaceae	-	+	-	+	-	-	-	+	+	-	-	-	-	-
95	*Momordica charantia* Linn.	Cucurbitaceae	-	+	-	-	-	-	-	+	+	-	-	-	-	-
96	*Cuscuta reflexa* L.	Cuscutaceae	-	+	-	-	-	+	-	-	+	-	-	-	-	-
97	*Cyperus exaltatus* Retz.	Cyperaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+

98	*Diospyrus kaki* Linn.	Ebenaceae	-	+	-	-	-	+	-	+	+	-	-	-	+	+
99	*Diospyrus lotus* Linn.	Ebenaceae	-	+	-	-	-	+	-	+	+	-	-	-	+	+
100	*Euphorbia granulata* L.	Euphorbiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
101	*Euphorbia helioscopia* Linn.	Euphorbiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
102	*Euphorbia hirta* L.	Euphorbiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
103	*Euphorbia prostrata* Ait.	Euphorbiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
104	*Euphorbia wallichii* Hook. f.	Euphorbiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
105	*Andrachne cordifolia* (Decne.) Mull. Arg.	Euphorbiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
106	*Quercus baloot* Griff., Itin. Not.	Fagaceae	-	+	-	+	-	+	-	-	-	-	+	-	+	+
107	*Quercus dilatata* Lindl.	Fagaceae	-	+	-	+	-	+	-	-	-	-	+	-	+	+
108	*Quercus incana* Roxb.	Fagaceae	-	+	-	+	-	+	-	-	-	-	+	-	+	+
109	*Quercus lanata* Smith in Rees,	Fagaceae	-	+	-	+	-	+	-	-	-	-	+	-	+	+
110	*Quercus semicarpifolia* Sm.	Fagaceae	-	+	-	+	-	+	-	-	-	-	+	-	+	+
111	*Fumaria indica* (Haussk.)	Fumariaceae	-	+	+	-	+	+	-	-	-	-	+	+	+	+
112	*Centaurium centroide*	Gentianaceae	-	-	+	-	+	+	-	-	-	-	+	-	-	-
113	*Megacodon stylophorus* (C. B. Clarke)	Gentianaceae	-	-	-	+	-	+	-	-	+	-	-	-	-	-
114	*Geranium rotundifolium* Linn.	Geraniaceae	-	-	-	+	-	+	-	-	+	-	-	-	-	-
115	*Geranium wallichianum* D. Don.	Geraniaceae	-	-	-	+	-	+	-	-	+	-	-	-	-	-
116	*Hypericum perforatum* L.	Guttiferae	-	-	-	+	-	-	+	-	+	-	-	-	-	-

117	*Morchella esculenta* Prs ex. fr.	Helveliaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
118	*Aesculus indica* (Colebr. Ex Cambess.)Hook.	Hippocastanaceae	-	+	-	-	-	+	-	-	+	-	-	-	+	+
119	*Juglan regia* L.	Juglandaceae	-	+	-	-	-	+	-	+	+	-	-	-	-	-
120	*Ajuga bracteosa* Wallich ex Benth.	Lamiaceae	-	+	-	-	-	+	-	-	-	+	-	-	+	+
121	*Ajuga parviflora* Benth.	Lamiaceae	-	+	-	-	-	+	-	-	-	+	-	-	+	+
122	*Eremostachys thyrsiflora* Bunge in Ledeb.,	Lamiaceae	-	-	-	+	-	+	-	-	+	-	-	-	-	-
123	*Leucas urticifolia* (Vahl.) Br.ex sm.	Lamiaceae	-	-	-	+	-	+	-	-	+	-	-	-	-	-
124	*Mentha arvensis* L.	Lamiaceae	-	+	-	+	+	+	-	-	-	-	+	-	+	+
125	*Mentha longifolia* (L.) Hudson.	Lamiaceae	-	+	+	-	+	+	-	-	-	-	+	-	+	+
126	*Mentha piperata* Linn.	Lamiaceae	-	+	+	-	+	+	-	-	-	-	+	-	+	+
127	*Mentha viridis* Linn.	Lamiaceae	-	+	+	-	+	+	-	-	-	-	+	-	+	+
128	*Micromaria biflora* (Ham.) Benth.	Lamiaceae	-	+	+	-	+	+	-	-	+	-	-	-	-	-
129	*Nasturtium officinale* R. Br.	Lamiaceae	-	+	+	-	+	+	-	-	+	-	-	-	-	-
130	*Nepeta clarkei* Hook.f.	Lamiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
131	*Nepeta erecta* (Benth.) Benth.	Lamiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
132	*Origanum vulgare* Linn.	Lamiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
133	*Osimum basilicum* Linn.	Lamiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
134	*Phlomis bracteosa* Royle	Lamiaceae	-	+	-	-	-	+	-	-	+	-	-	-	-	-

135	*Prunella vulgaris* Linn.	Lamiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
136	*Salvia lanata* Roxb	Lamiaceae	-	+	-	-	-	+	-	-	+	-	-	-	+	+
137	*Salvia moorcroftiana* Wall.	Lamiaceae	-	+	-	-	-	+	-	-	+	-	-	-	-	-
138	*Salvia nubicola* Wall.	Lamiaceae	-	-	-	+	-	+	-	-	+	-	-	-	+	+
139	*Stachys emodi* Hedge (S. I. Ali & Y. J. Nasir)	Lamiaceae	-	-	-	+	-	+	-	-	+	-	-	-	-	-
140	*Thymus serphylum* Benth.	Lamiaceae	-	-	-	+	-	+	-	-	+	-	-	-	-	-
141	*Plectranthus rugosus* Wall. ex Benth.	Lamiaceae	-	-	-	+	-	+	-	-	+	-	-	-	-	-
142	*Stachys seriaca* Wall. ex Benth.	Lamiaceae	-	-	-	+	-	+	-	-	+	-	-	-	+	+
143	*Linum usittisimum* L.	Linaceae	-	+	-	-	-	-	-	+	+	-	-	-	+	+
144	*Woodfordia fruticosa* (L.) Kurz.	Lythraceae	-	+	-	-	-	+	-	-	+	-	-	-	+	+
145	*Abutilon indicum* Sweet.	Malvaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
146	*Althea rosea* (Linn.) Cav.	Malvaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
147	*Malvestrum coromandelianum* (Linn) Garoke.	Malvaceae	-	+	-	-	-	+	-	-	+	-	-	-	+	+
148	*Hibiscus esculentus* L.	Malvaceae	-	-	+	-	-	-	-	+	+	-	-	-	-	-
149	*Hibiscus rosa chinensis* Linn.	Malvaceae	-	-	+	-	-	-	-	+	+	-	-	-	+	+
150	*Malva neglecta* Wallr.	Malvaceae	-	+	-	-	+	-	-	+	+	-	-	-	+	+
151	*Melia azadarichta* Linn.	Meliaceae	-	+	+	-	-	+	-	-	+	-	-	-	+	+
152	*Acacia modesta* Wall.	Mimosaceae	-	+	+	-	-	-	-	+	+	-	-	+	+	+

153	*Acacia nilotica* (L.) Delile	Mimosaceae	-	+	+	-	-	+	-	-	+	-	-	+	+	+
154	*Broussonetia papyrifera* Vent.	Moraceae	-	+	-	-	-	+	-	-	+	-	-	-	+	+
155	*Ficus bengalensis* Linn.	Moraceae	-	+	-	-	-	+	-	-	+	-	-	-	-	-
156	*Ficus carica* Linn.	Moraceae	-	+	-	-	-	+	-	-	+	-	-	-	+	+
157	*Ficus elastica* Roxb.	Moraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
158	*Ficus palmata* Forssk.	Moraceae	-	+	-	-	-	+	-	-	+	-	-	-	+	+
159	*Ficus racemosa* Linn.	Moraceae	-	+	-	-	-	+	-	-	+	-	-	-	+	+
160	*Ficus religiosa* Linn.	Moraceae	-	+	-	-	-	+	-	-	+	-	-	+	+	+
161	*Morus alba* Linn.	Moraceae	-	+	+	-	-	+	-	+	+	-	-	-	+	+
162	*Morus laevigata* Wall.	Moraceae	-	+	+	-	-	+	-	+	+	-	-	+	+	+
163	*Morus nigra* L.	Moraceae	-	+	+	-	-	+	-	+	+	-	-	+	+	+
164	*Myrtus communis* Linn.	Myrtaceae	-	+	-	+	-	-	-	+	+	-	-	-	-	-
165	*Psidium guajava* L.	Myrtaceae	-	+	-	-	-	-	-	+	+	-	-	-	+	+
166	*Boerhaavia diffusa* L.	Nyctaginaceae	-	+	-	-	-	-	-	+	+	-	-	-	+	+
167	*Olea ferruginea* Royle.	Oleaceae	-	+	-	-	-	-	-	+	+	-	-	-	+	+
168	*Jasminum grandiflorum* L.	Oleaceae	-	-	-	-	-	-	+	-	+	-	-	-	-	-
169	*Jasminum multiflorum* L.	Oleaceae	-	-	-	-	-	-	+	-	+	-	-	-	-	-
170	*Oxalis corniculata* Linn.	Oxalidaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
171	*Oxalis corymbosa* DC.	Oxalidaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
172	*Oxalis pes capre* Linn.	Oxalidaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
173	*Paeonia emodi* Wall.Hkf.	Paeoniaceae	-	-	-	+	+	-	-	+	-	-	+	-	-	-

174	*Papaver somniferum* Linn.	Papaveraceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
175	*Astragalus chlorostachys* Lindl.	Papilionaceae	-	+	-	+	-	+	-	-	+	-	-	-	+	+
176	*Astragalus pyrrotrichus*	Papilionaceae	-	+	-	+	-	+	-	-	+	-	-	-	+	+
177	*Dalbergia sissio* Roxb.	Papilionaceae	-	+	+	-	-	+	-	-	+	-	-	+	+	+
178	*Desmodium elegans* DC.	Papilionaceae	-	+	+	-	-	+	-	-	+	-	-	+	+	+
179	*Indigofera hetrantha* Wall.	Papilionaceae	-	+	+	-	-	+	-	-	+	-	-	-	+	+
180	*Lathyrus aphaca* Linn.	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
181	*Lathyrus odoratus* Linn.	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
182	*Lathyrus sativa* Linn.	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
183	*Lespedeza juncea* (Linn. F.) Pers.	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
184	*Medicago minima* (Linn.) Grufb	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
185	*Medicago sativa* Linn.	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
186	*Melilotus alba* Desr.	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
187	*Pisum sativum* Linn.	Papilionaceae	-	+	+	-	-	-	-	+	+	-	-	+	+	+
188	*Robinia pseudocacia* Linn.	Papilionaceae	-	+	-	+	-	+	-	-	+	-	-	+	+	+
189	*Trifolium alexandrium* Linn.	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
190	*Trifolium repense* Linn.	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
191	*Trigonella foenum-graecum* Linn.	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
192	*Visia faba* Linn.	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
193	*Vicia hirsuta* (L.) S. F. Gray	Papilionaceae	-	+	+	-	+	+	-	-	+	-	-	+	+	+
194	*Crotolaria juncea* L.	Papilionaceae	-	+	+	-	-	+	-	-	+	-	-	+	+	+

195	*Lespedeza juncea* (Linn.f) Pers.	Papilionaceae	-	+	+	-	-	+	-	-	+	-	-	+	+	+
196	*Plantigo lanceolata* Linn.	Plantiginaceae	-	+	-	+	+	+	-	-	+	-	-	+	+	+
197	*Plantigo major* Linn.	Plantiginaceae	-	+	-	+	+	+	-	-	+	-	-	+	+	+
198	*Plantigo ovata* Forssk.	Plantiginaceae	-	+	-	+	+	+	-	-	+	-	-	-	+	+
199	*Platinus orientalis* Linn.	Plantinaceae	-	+	-	+	-	+	-	-	+	-	-	-	+	+
200	*Podophylum emodi* Wall.	Podophyllaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
201	*Polygonum aviculare* Linn.	Polygonaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
202	*Polygonum barbatum* Linn.	Polygonaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
203	*Polygonum glabrum* Willd.	Polygonaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
204	*Polygonum plebejum* R. Br.	Polygonaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
205	*Rumex aviculare* L.	Polygonaceae	-	+	-	-	-	+	-	-	-	-	+	-	-	-
206	*Rumex dentatus* Linn.	Polygonaceae	-	+	+	-	-	+	-	-	-	-	+	+	+	+
207	*Rumex hastatus* D. Don..	Polygonaceae	-	+	+	-	-	+	-	-	-	-	+	+	+	+
208	*Rumex naphalensis* Sprengel	Polygonaceae	-	+	+	-	-	+	-	-	-	-	+	+	+	+
209	*Rumex persicaria* L.	Polygonaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
210	*Eichornia crassipa* (Mart.) Solms	Pontederiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
211	*Portulaca oleracea* L.	Portulacaeae	-	+	+	-	-	+	-	-	-	-	+	+	+	+
212	*Anagalis arvensis* Linn.	Primulaceae	-	+	+	-	-	+	-	-	-	-	+	+	+	+
213	*Anagalis caerulea* (Schreb.) Gren. & Godr.	Primulaceae	-	+	+	-	-	+	-	-	-	-	+	+	+	+
214	*Androsace rotundifolia* Hardw.	Primulaceae	-	+	-	+	-	+	-	-	-	-	+	-	+	+

215	*Punica granata* L.	Punicaceae	-	+	-	+	-	-	-	+	-	+	-	-	+	+
216	*Aconitum violate* Jacque. Staff.	Ranunculaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
217	*Aquilegia pubiflora* Wallich ex Royle	Ranunculaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
218	*Clematis grata* Wall.	Ranunculaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
219	*Delphinium ajacis* Linn.	Ranunculaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
220	*Delphinium denudatum* Wallich ex Hook. F.	Ranunculaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
221	*Ranunculus equitalis* L.	Ranunculaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
222	*Ranunculus murricatus* Linn.	Ranunculaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
223	*Thalictrum pendunculatum* Edgew.	Ranunculaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
224	*Segeretia thea* (L.) Brongn.	Rhamnaceae	-	+	-	+	-	+	-	-	-	-	+	-	+	+
225	*Cotoneaster nummularia* Fish &Mey	Rosaceae	-	+	-	+	-	+	-	-	-	-	+	-	+	+
226	*Duchesnia indica* Forssk.	Rosaceae	-	+	+	-	-	-	-	+	+	-	-	-	+	+
227	*Fragaria vesica* Lindl.	Rosaceae	-	+	+	-	-	-	-	+	+	-	-	-	+	+
228	*Geum elatum* L.	Rosaceae	-	+	-	+	-	+	-	-	-	-	-	-	+	+
229	*Malus pumila* Mill.	Rosaceae	-	+	-	+	-	-	-	+	+	-	-	-	+	+
230	*Prunus armeniaca* Linn.	Rosaceae	-	+	-	+	-	-	-	+	+	-	-	-	+	+
231	*Prunus bukharensis* Royle	Rosaceae	-	+	-	+	-	-	-	+	+	-	-	-	+	+
232	*Prunus persica* (Linn.) Batsh	Rosaceae	-	+	-	+	-	-	-	+	+	-	-	-	+	+

233	*Pyrus communis* Linn.	Rosaceae	-	+	-	+	-	-	-	+	+	-	-	-	+	+
234	*Pyrus pashia* Ham.	Rosaceae	-	+	-	+	-	-	-	+	+	-	-	-	+	+
235	*Rosa indica* L.	Rosaceae	-	+	-	+	-	-	+	-	+	-	-	-	+	+
236	*Rosa macrophylla* Lindl.	Rosaceae	-	+	-	+	-	-	+	-	+	-	-	-	-	-
237	*Rosa webbiana* Wallich ex Royle,	Rosaceae	-	+	-	+	-	-	+	-	+	-	-	-	-	-
238	*Rubus ellipticus* Smith.	Rosaceae	-	+	-	+	-	-	-	+	-	+	-	-	-	-
239	*Rubus foliolosus* D. Don	Rosaceae	-	+	-	+	-	-	-	+	-	+	-	-	-	-
240	*Rubus fruticosus* L.	Rosaceae	-	+	-	+	-	-	-	+	-	+	-	-	-	-
241	*Rubus sanctus* Schreb.	Rosaceae	-	+	-	-	-	-	-	+	-	+	-	-	-	-
242	*Spirea Lindleyana* Wall.	Rosaceae	-	+	-	-	-	-	+	-	-	+	-	-	-	-
243	*Cotoneaster nummularia* Fish & Mey	Rosaceae	-	+	-	+	-	+	-	-	-	+	-	-	-	-
244	*Crataegus oxycantha* L.	Rosaceae	-	+	-	+	-	+	-	-	-	+	-	-	-	-
245	*Eriobotrya japonica* (Thumb.) Lindl.	Rosaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
246	*Galium aparine* Linn.	Rubiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
247	*Galium elegans* Wall.	Rubiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
248	*Rubia cordifolia* Linn.	Rubiaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
249	*Citris medica* L.	Rutaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
250	*Citrus acida* Brandis	Rutaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
251	*Citrus auritinum*	Rutaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-

252	*Zanthoxylum armatum* DC.	Rutaceae	-	-	-	+	-	-	-	+	-	+	-	-	-	-
253	*Salix babylonica* L.	Salicaceae	-	+	-	+	-	+	-	-	-	-	+	+	+	+
254	*Salix tetrasperma* Roxb. Pl. Corom.	Salicaceae	-	+	-	+	-	+	-	-	-	-	+	+	+	+
255	*Monotheca bauxifolia* (Fale) Dcne ex. Engler	Sapotaceae	-	+	-	+	-	-	-	+	-	-	+	-	-	-
256	*Bergenia ciliata* (Haw) Sternb	Saxifragaceae	-	+	-	-	-	+	-	-	-	-	+	-	-	-
257	*Verbascum thapsis* L.	Schruphulariaceae	-	-	-	+	-	+	-	-	-	-	+	-	+	+
258	*Ailanthus altissima* (Miller) Swingle	Simaroubaceae	-	+	+	-	-	+	-	-	-	-	+	+	+	+
259	*Capsicum annuum* Linn.	Solanaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
260	*Datura innoxia* Mill.	Solanaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
261	*Lycopersicum esculentum* Millers	Solanaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
262	*Solanum melongena* Linn.	Solanaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
263	*Solanum nigrum* L.	Solanaceae	-	+	+	-	+	+	-	+	-	-	+	+	+	+
264	*Solanum pseudocapsicum* L.	Solanaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
265	*Solanum surretensis* Burm. f.	Solanaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
266	*Solanum villosum* Mill.	Solanaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
267	*Withania somnifera* L.	Solanaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
268	*Daphne oloides* Schreb.	Thymeliaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
269	*Grewia optiva* Drum. Ex Burret.	Tiliaceae	-	-	-	+	-	+	-	-	-	-	+	-	+	+
270	*Celtis australis* Wild.	Ulmaceae	-	-	-	+	-	+	-	-	-	-	+	-	+	+

271	*Gerardiana palmata* (Forssk.)Gaud.	Urticaceae	-	-	-	+	-	+	-	-	-	-	+	-	-	-
272	*Urtica dioica* Linn.	Urticaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
273	*Urtica hyperborea* L.	Urticaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
274	*Debregetia salisifolia* (D. Don) Renle.	Urticaceae	-	-	-	+	-	+	-	-	-	+	-	-	+	+
275	*Valeriana*	Valerianaceae	-	+	-	-	-	+	-	-	-	+	-	-	-	-
276	*Vigna vexillata* (L.) A.Rich.	Violaceae	-	+	-	+	-	+	-	+	-	+	-	+	+	+
277	*Viola biflora* L.	Violaceae	-	+	-	+	-	-	+	-	-	+	-	+	+	+
278	*Viola serpens* Wall. Ex Roxb.	Violaceae	-	+	-	+	-	-	+	-	-	+	-	-	-	-
	Sub Total		75	168	80	76	53	150	16	53	145	17	44	71	136	132
Monocotyledons																
1	*Allium humile* Kunth.	Alliaceae	-	+	-	-	-	+	-	-	-	-	+	-	-	-
2	*Asparagus officinalis*	Asparagaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
3	*Asphodelous tennifolius* Cavan.	Asphodelaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
4	*Aristida cyanantha* Steud.	Poaceae	-	+	+	-	-	+	-	-	+	+	-	+	+	+
5	*Aristida depressa* Retz., Ohs.	Poaceae	-	+	+	-	-	+	-	-	+	+	-	+	+	+
6	*Avena sativa* L.	Poaceae	-	+	+	-	-	+	-	-	+	+	-	+	+	+
7	*Bromus japonica* Thunb.	Poaceae	-	+	+	-	-	+	-	-	+	+	-	+	+	+
8	*Bromus tectorum* L.	Poaceae	-	+	+	-	-	+	-	-	+	-	-	+	+	+
9	*Cenchrus ciliaris* L.	Poaceae	-	+	+	-	-	+	-	-	+	+	-	+	+	+

10	*Chrysopogon aucheri* (Boiss.) stapf	Poaceae	-	+	+	-	-	+	-	-	+	+	-	+	+	+
11	*Cyanodon dactylon* (L.) Pers.	Poaceae	-	+	+	-	-	+	-	-	+	-	-	+	+	+
12	*Dactylis glomerata* L.	Poaceae	-	+	+	-	-	+	-	-	+	+	-	+	+	+
13	*Dichanthium annulatum* (Forssk.) Stapf.	Poaceae	-	+	+	-	-	+	-	-	+	-	-	+	+	+
14	*Eragrostis japonica* (Thunb.) Trin.	Poaceae	-	+	+	-	-	+	-	-	+	-	-	+	+	+
15	*Imperata cylindrica* (L.) Raeuschel	Poaceae	-	+	+	-	-	+	-	-	+	+	-	+	+	+
16	*Fimbristylis squarrosa* Vahl.	Poaceae	-	-	-	+	-	+	-	-	-	+	-	+	+	+
17	*Hordeum vulgare* L.	Poaceae	-	+	+	-	-	+	-	-	-	-	+	+	+	+
18	*Oryza sativa* L.	Poaceae	-	+	+	-	-	+	-	-	-	+	+	+	+	+
19	*Pennisetum orientale* Rich.	Poaceae	-	+	+	-	-	+	-	-	-	+	+	+	+	+
20	*Poa annua* L.	Poaceae	-	+	+	-	-	+	-	-	-	+	+	+	+	+
21	*Saccharum munja* Roxb.	Poaceae	-	+	-	+	-	+	-	-	-	+	+	-	-	-
22	*Saccharum spontanum* L.	Poaceae	-	+	-	-	-	+	-	-	-	+	+	-	-	-
23	*Brachiaria reptens* (L.) Stapf.	Poaceae	-	+	+	-	-	+	-	-	+	-	-	+	+	+
24	*Sorghum nephalensis* (L.) Hill.	Poaceae	-	+	+	-	-	+	-	-	-	+	+	-	+	+
25	*Sorghum nitidum* (Vahl) Pers.,	Poaceae	-	+	+	-	-	+	-	-	-	+	+	-	-	-
26	*Themeda anathera* (Nees ex Steud.) Hack.	Poaceae	-	+	+	-	-	+	-	-	-	+	+	+	+	+
27	*Triticum aestivum* L.	Poaceae	-	+	+	-	-	+	-	-	-	+	+	+	+	+
28	*Zea mays* L.	Poaceae	-	+	+	-	-	+	-	-	-	+	+	+	+	+

Sub Total	2	25	22	2	0	26	0	0	13	19	12	21	22	22
Grand Total	86	197	102	81	53	181	16	53	161	36	59	92	160	156

Key Words: NP = Non Palatable, P = Palatable, HP = Highly Palatable, LP = Low Palatable, W = Whole Plant, L= Leaves, Fl = Flowers, Fr = Fruits, Frsh = Freshness, D = Dried, B = Both, C = Cattle, G = Goats and S = Sheep.

Mineral Composition

Fourteen species were analyzed for 13 most important minerals including trace, heavy and essential metals at three phenological stages i.e. vegetative, reproductive and post reproductive stages. The results are as follows.

Trace Elements (Micro Elements)

Trace elements or micro elements are required in minute quantity (5ppm – 200ppm i.e. less than 0.002%) by the plants. These elements include copper, zinc, manganese, nickle, iron and sodium.

Copper

Copper is essential trace element, found in mono and divalent forms and is also present in human, animal and plant body. The permissible limit of Cu is 10 ppm in plants (Markert, 1994). The range of Cu in our study was 12 - 93.8 ppm in vegetative stage, 3 - 216 ppm in reproductive stage and 12 – 51 ppm in post reproductive stage (Tables. 1; Fig. 1). It had maximum of 93.8 ppm in *Cenchrus ciliaris,* followed by *Bromus glomerata* (33.4 ppm), *Ajuga bracteosa* (29.8 ppm) in vegetative stage. The highest concentration of Cu was recorded in *Amaranthus viridis* (216 ppm) followed by *Brachiaria reptens* (120 ppm). *Amaranthus viridis* (33.2 ppm) and *Bromus glomerata* (33 ppm) in reproductive stage. It was 51.2 ppm in *Polygonum glabrum* followed by *Hypericum perforatum* (45 ppm), *Ajuga bracteosa* (44.8 ppm) and *Rumex hastatus* (31.4 ppm) at post reproductive stage. The lowest content was recorded in *Rumex dentatus* (3.0 ppm) followed by *Fimbristylys squarrosa* (5.8 ppm) at reproductive stage at all phenological stages. The lowest average concentration was also found in *Fimbristylys squarrosa* (13.8 ppm) at all three phenological stages. Similarly, highest average concentration was found in *Amaranthus viridis* (83.7 ppm). The overall average concentrations recorded across the plant species and at three different stages were 26.3 ppm, 43.3 ppm and 25.6 ppm in vegetative, reproductive and post reproductive stages, respectively.

These plants were collected in the valley at various heights which have a wide range of concentration than plants of the plains. The results revealed that *Fimbristylys squarrosa* represented the lowest average of copper contents all the phenological stages. It is a non palatable plant avoided by cattles, goat and sheep. The plant grows progressively with luxurious growth. It was found only in Gumrush Hills on south face which is undisturbed. The species occurs at margins of the mountains and along the pavement.

Using statistical package, ANOVA two factors without replicate data, indicated that variance among the different plants for Cu contents and between different stages were non significant. It was observed that *Amaranthus viridis* with highest average of copper content in vegetative stage and highest content in reproductive stage. Copper contents increased with maturity of the species due to accumulation. Sultan *et al.* (2008) reported that Cu concentration increased with age in rangeland grasses and these results supported the present findings. It is obvious that Cu content increased from vegetative stage to reproductive stage and then declined at post reproductive stages. Copper contents were higher in all the grasses than livestock requirement i.e. 6-12 ppm (Anonymous, 1975). It is true for our results. The Table 1.2 showed that all grasses had higher concentration of Cu.

Said *et al.* (1996) reported copper in all parts of *Rumex hastatus*. Our results (Table 1.1) also showed similar behavior. Ayoola *et al.* (2010) analyzed the presence of trace elements like Cu, Zn, Mn, Cr, Cd, and Pb in *Spondias mombin*, *Veronia amyggdalina* and *Momordica charantia*. Copper had highest concentration in *Cassia angustifolia*, *Mentha sylvestris*, and *Sphaeranthus hirtius* (Hussain *et al.* 2009). In our case *Amaranthus viridis* was the best source of Cu as it had higher concentration than other plants. Hussain *et al.* (2009) reported highest content of Cu in *Valeriana officinalis*. James & Friday (2010) reported that very low micronutrient contents in leaf, fruits and seeds of *Saba florida* (apocynaceae). Hameed *et al.* (2008) studied microelements like Co, Cr, Cu, Na, Mn, Fe, Rb and Zn in *Rumex hastatus, R. nepalensis* and reported the absent from flowers of *Rumex hastatus*. Baligar *et al.* (2001) stated that nutritional quality of plants is primarily controlled by concentration of essential nutrients. Minson (1990) and Sultan *et al.*(2008) reported that increased Mo intake prevents Cu toxicity in

livestock. They also investigated that increasing soil temperature also increase its concentration of copper in plants. Temperate legume had more Cu than temperate grasses. Shah *et al.* (1986) stated that increase in Cu contents in forage promotes maturity. This agrees with our findings (Table 4.1) as reproductive stage the plant had maximum Cu content. As degradation and lapses in metabolic activities occur, it goes toward aging which Cu content decreases. Gohl (1981) also reported similar behavior of decline of Cu with age of plants.

Zinc

This trace element is found in all the living organisms. There are 100 – 200 enzymes dependent for its activity on Zn. Human body on the average has 2 – 4 g Zn. It is an essential element for metabolism of RNA and DNA. The permissible limit of Zn is 50 ppm in medicinal plants (Markert, 1994).

Ajuga bracteosa had the highest concentration (214.6 ppm) followed by *Polygonum glabrum* (115.4 ppm), *Solanum nigrum* (90.2 ppm), *Amaranthus viridis* (88.2 ppm), *Artemisia scentifolia* (74.8ppm) and *Bromus pectinatus* (67.4 ppm) in vegetative stage (Table 1). The data revealed that the highest content of Zn in reproductive stage was found in *Bromus pectinatus* (90.4 ppm), *Ajuga bracteosa* (90 ppm), *Setaria viridis* (78.8 ppm), *Cenchrus ciliaris* (67.2 ppm) and *Amaranthus viridis* (62.6 ppm). The lowest level was recorded in, *Rumex dentatus* (21.6 ppm) and *Fimbristylys squarrosa* (41.4 ppm) (Table 2). *Polygonum glabrum* (192.6 ppm), *Ajuga bracteosa* (149.2 ppm), *Solanum nigrum* (96.8 ppm), *Brachiaria reptens* (88.6 ppm) and *Artemisia scentifolia* (85 ppm) had the highest level of Zn at post reproductive stages (Table 3; Fig. 2).

Generally Zn was found in all plants at all the three stages except *Hypericum perforatum* where it was absent at vegetative stage. On the average Zn was highest (71 ppm) at vegetative stages followed by post reproductive stage (70 ppm) and reproductive stage.

The average level of Zn in vegetative stages across the investigated species was 71.1 ppm, which was the highest average in all the three stages. The lowest average was recorded in reproductive stage (57.1 ppm). *Ajuga bracteosa* and *Amaranthus viridisi* had the maximum average level of Zn on individual basis with similar concentration (151.3

ppm). The lowest average was recorded on individual basis was that of *Fimbristylys squarrosa* (35.7 ppm).

Analysis by ANOVA indicated that variation in Zn content between different species was highly significant, but it was non significant between different stages (Table 4.2). The average level of Zn in vegetative stages across the species was 71.1 ppm. which was the highest average across the phenological stages. The lowest average was recorded in reproductive stage (57.1 ppm).

Zn is an important for nerve function and male fertility. It is also important for normal development of gonads. It enhances vitamin activity and formation of RBC and WBC (Claude & Solomon, 1979).

The results revealed that grasses had generally low content of Zn than the forbs (table 1.1). Sultan *et al.*(2008) also described that grasses contained less Zn than legumes and Zn deficiency rarely occur in ruminant fed such forages. They discussed Zn concentration is not affected by changes in climate or maturity of grasses. The present study disagreed with decrease in Zn level with increase of age and with climatic conditions. Khan *et al.* (2006) supported our results that a number of factors including soil, plant species, pasture management and climate may affect the likelihood of Zn deficiency in ruminants. They also described that plant maturity affect Zn concentration of forage and also depend upon the tissue types of plants. Pasture forage had slightly lower level of Zn than mean content of required for ruminants (Mc Dowell *et al.*, 1985, Nasrullah *et al.*, 2003, Serra *et al.*, 1997 and Khan *et al.*, 2006).

Hussain *et al.* (2009) investigated eight species for micronutrient analysis. They found that Zn was highest in *Mentha sylvestris.* In our study, Zn was highest in *Polygonum glabrum* (192.6 ppm) in post reproductive stages while its average (119.4 ppm) also highest level in this plant. Zafar *et al.*(2010) and Iqbal *et al.*(1999) classified Zn as essential element. It plays an important role in plant biochemical system. It helps in wound healing and is strong antioxidant. Its deficiency related to the productivity and vitality. Adnan *et al.* (2010) found it in higher level in *Forsskalea tenacissima* ranges between 25n-150 mg/ kg and above the deficiency level of 20 mg/lit. However, *Bupleurum falcatum* (18 mg/ kg) had deficient level of Zn. Rehman & Iqbal (2008) investigated high Zn contents in leaves collected from industries. Hussain *et al.*, 2009

stated that Zn deficiency is an important health problem in 3rd world countries. The average daily intake of Zn is less than 70µg/day and 20 % of the world population faces Zn deficiency (Hussain *et al.*2010).

Manganese (Mn)

Manganese is essential for development of chloroplast. Its deficiency leads to the discoloration of leaves and other parts of the plant. The permissible quantity in plants is 200 ppm. Maximum concentration of Mn was recorded in *Polygonum glabrum* (294.6 ppm) in post reproductive stage, followed by *Amaranthus viridis* (279.8 ppm) in vegetative stage and *Setaria viridis* (270.6 ppm) in reproductive stage (Tables 1, 2). Generally higher concentration was recorded in the vegetative stage with average of 158.9 ppm followed by post reproductive stage with 133.5 ppm and reproductive stage (108.9 ppm) (Fig. 4).

The *Fimbristylys squarrosa* had the lowest concentration of (22.6 ppm and 24.8 ppm) reproductive and vegetative stage, respectively. *Amaranthus viridis* (25.2 ppm) had one in post reproductive stage that has lowest content of Mn. Average level of Mn was found to be highest in *Setaria viridis* (218.7 ppm) at all stages in all plants. The lowest average recorded in *Fimbristylys squarrosa* (34.9 ppm). as a whole reproductive stage represented lowest average of 108.9 ppm.

The analysis of the results by ANOVA revealed that variance among the plants and between different phenological stages of these plants are non significant. The lowest content of Mn recorded in *Fimbristylys squarrosa* followed by *Bromus pectinatus*. *Polygonum glabrum* had highest level. It aids in enzymes needed for chlorophyll formation. It is an essential micronutrient and important for many vital functions in plants. It acts as cofactor and helps in synthesis of carotene, riboflavin and ascorbic acid (Ducic & Polle, 2005). It is important for the functioning of gonads and combat anemia. *Dalbegia sisso* and *Phlomis kashmeriana* had significant level of Zn (Hussain *et al.*, 2010). Adnan *et al.* (2010) investigated higher level in *Valeriana officinalis* (269 ppm). Similarly *Polygonum glabrum* had 294.6 ppm in post reproductive stage, *Amaranthus viridis* 279.8 ppm in vegetative stage and *Setaria viridis* 270.6 ppm in vegetative stage. These values are much higher than that reported so for. The plants had collected from 5400 ft asl. It seemed that plant

nutrients greatly vary with altitudes and climate and these are the key factors to play its part to distinguish them from other plants. The Mn level in the selected plants varied from 24.8 ppm to 279.8 ppm in early stages and its concentration varied from 22.6 ppm to 270.6 ppm in blooming stage. The Mn content increases with maturity of plants. Our results agreed with those of Rahim *et al.* (2008), Hussain *et al.* (2010), Zafar *et al.* (2010), Sultan *et al.*(2008) and Gohl (1981). Perveen, (1998) discussed that Mn content in free rangeland grasses were ample to meet up the livestock supplies.

Nickle

The range of Ni in vegetative stage ranged from 2ppm to 324ppm (Table 1). The highest concentration was recorded in *Brachiaria reptens* (466 ppm) in reproductive stage followed by *Rumex hastatus* (324 ppm) and *Rumex dentatus* (316 ppm) in vegetative stage. The average content of Ni was 115.7 ppm in vegetative stage, 7.1 ppm in reproductive stage and 105 ppm in post reproductive stage. It was obvious from the Fig.5 that the average Ni content was lowest in reproductive stage and highest in vegetative state. In Artemisia *scentifolia* Ni was missing in all the three phenological stages. *Rumex hastatus* had no Zn at reproductive and post reproductive stages (Fig. 5). The differences were non significant in vegetative stage in *Polygonum glabrum* and *Ajuga bracteosa,* in reproductive stage in *Fimbristylys squarrosa, Bromus pectinatus, Hypericum perforatum* and *Solanum nigrum.* Nickle was absent *Rumex hastatus, Bromus glomerata, Cenchrus ciliaris* and *Amaranthus viridis* Ni at post reproductive stage (Tables 2 & 3).

The lowest average was recorded in *Amaranthus viridis* (20.7 ppm) while highest level of Ni was found in *Rumex dentatus* (260.7 ppm) at three phenological stages at individual position. Generally, reproductive stage had lowest content of Ni while vegetative stage had higher level (115.7 ppm). however, Ni content varied from 2 ppm – 324 ppm in vegetative stage, 18 ppm – 466 ppm in reproductive stage and 130 – 250 ppm in post reproductive stage (Table 1.1, Fig..).

The ANOVA table revealed that variation among plants and at phenological stages were non sisnificant. Because three plant species were missing Ni at vegetative stage, five species at reproductive stage and six were missing at post reproductive stage.

The results revealed that *Artemisia scentifolia* completely missing Ni in all phenological stages while *Polygonum glabrum* and *Ajuga bracteosa* lacking it vegetative stages. Ni content is negligible in *Fimbristylys squarrosa, Rumex hastatus, Bromus pectinatus, Hypericum perforatum* and *Solanum nigrum* at reproductive stages. While *Brachiaria reptens Rumex hastatus, Bromus glomerata, Cenchrus ciliaris,* and *Amaranthus viridis* lacking it in post reproductive stage. It showed that plants depleted Ni mostly in later stage of their life cycle. It may lose the intake property from soil.

Zafar *et al.*(2010) found that mineral nutrients varying in concentration in plants. It varied from 12.5-35.2 ppm in *(Fagonia indica, Solanum surretense).*Our results also confirmed that it is not important to be present it in all stages of plants. Adnan *et al.*(2010) recorded highest concentration of Ni in *Otostegia lambata.* We investigated highest level of Ni in *Brachiaria reptens* (466.0 ppm) in pre juvenile stage. Rehman & Iqbal (2008) also indicated highest content of Ni in *Euclaptus* species and *Ficus religiosa* leaves. Hussain *et al.*(2009) obtained Ni in range lower than 0.05 -5 mg/kg.

Iron

This important trace element is necessary for photosynthesis and present as enzyme cofactor. Its deficiency results in interveinal chlorosis and necrosis. The highest concentration was noted in *Ajuga bracteosa* (1124.8ppm) in post reproductive stage, reproductive stage (968 ppm) followed by in vegetative stage (944 ppm). *Ajuga bracteosa* has the highest concentration in all its three phenological stages (Fig. 3) among the tested species. The Fe contents of *Amaranthus viridis* (740.2 ppm), *Setaria viridis* (642.4 ppm), *Hypericum perforatum* (558 ppm) were high in vegetative stage (Table 1), they were followed by *Setaria viridis* (622 ppm) and *Amaranthus viridis* (506 ppm) in reproductive stage (Table 2). *Hypericum perforatum* (739.6 ppm), *Setaria viridis* (636.6 ppm) and *Amaranthus viridis* (347.6 ppm) had high level of Iron in post reproductive stages (Table 3).

Bromus glomerata (23.8 ppm) followed by *Bromus pectinatus* had (50.2 ppm) in post reproductive stage. Figure 3 shows the average iron contents were high in the vegetative stage of the plants i.e. 338.7 ppm and was recorded lowest average in reproductive stage i.e. 270.4 ppm among the species.

The table 1.1 showed that *Ajuga bracteosa* had the highest level of iron at all three phenological stages with average 1013 ppm. This is the highest average in all plants foe iron contents. The lowest average recorded for reproductive stage and highest average of iron found in vegetative stage. The lowest average of iron on individual basis was recorded in *Bromus glomerata* (70.1 ppm). The results also explained that iron varied from 78.6 ppm to 944.8 ppm in vegetative stage, 72.2 – 968 ppm in reproductive stage and 23.8 -1125 ppm in post reproductive stage. However the average level of iron varied from 70.1 -1013 ppm in all tested plants.

ANOVA showed that the variation of iron concentration in different plant species were highly significant and between the different phenological stages was non significant (table 1.4).

Iron is an important element for red corpuscles, oxygen carrying pigment. It is used against tuberculosis, anemia and energizer. Its excess can cause fatigue (Claude & Solomon, 1979). It plays a vital role in oxidation of hemoglobin, carbohydrates, fats and protein. It is also required for normal functioning of the nervous system (Hussain *et al.*, 2010; Adeyeye & Otokiti, 1999).

The results revealed that *Ajuga bracteosa* is the best source of iron and is widely used in the valley as antipyretic and tonic. It is obvious that plant contained iron (1013 ppm) and is useful against anemic diseases. *Amaranthus viridis* was collected fron Bakht Banda site about 7500 feet asl. It followed *Ajuga bracteosa* in highest level of iron content. The people used this plant continuously as pot herb and very affective in nephrotic problems. The *Bromus glomerata* had (70.1ppm) lowest content of it. The all tested forage was considered best for milk production and also increase weight of cattle. Hussain *et al.* (2009) reported highest level of iron in *Hypericum perforatum* (1020.4 ppm) while our results had showed 739.6 ppm in later stage of it. James *et al.* (2010) analyzed that *Saba florida* had highest iron content in seeds followed by leaves. Hussian *et al.* (2010a) reported highest level of iron in *Trianthema potulacastrum.* Hussian *et al.* (2010b) reported maximum content of iron in *Phlomis kashmeriana.* Rehman & Iqbal (2008) discovered that plants growing in polluted areas like in Karachi and on road side accumulated ferric in their leaves. Adnan *et al.* (2010) observed more iron level in plants of humid region than sub humid areas. They reported highest level of iron in *Valeriana*

officinalis (2787 ppm). They explained that various level of iron in plants in different habitats was due to variable soil and physical conditions. We had also maximum value of iron in plants of humid climate. This supports our results. Hameed *et al.* (2008) also reported iron content in *Polygonum plebjum, Rumex hastatus* and petiole of *Rumex nephalensis.* Khan *et al.*(2006) discussed that iron content was higher in forage of grazing pastures. Similarly, Kabata – Pendiaus & Pendias (1992) had the view that conditions of soil and climate affect the absorption of iron keeping physiological state of plants.

Sodium

Sodium is very low at all the phenological stages in tested species. The maximum amount of sodium was recorded in *Rumex dentatus* (9.94 ppm) in post reproductive stage, followed by *Setaria viridis* (6.86 ppm) and *Solanum nigrum* (6.26 ppm) in the same stage (Fig.11). The vegetative and reproductive stages had very low contents on the average ranged from 3.5 ppm to 0.0041 ppm. Sodium could not be traced in *Polygonum glabrum* and *Bromus glomerata.* The vegetative stage while *Bromus pectinatus* and *Rumex dentatus* in reproductive stage. It was interesting that all tested species had Na contents in post reproductive stage (Tables 1, 2, 3). The lowest average of sodium was recorded in *Bromus glomerat* and *Amaranthus viridis.* The highest average was recorded in *Amaranthus viridis* (3.3 ppm) for sodium level. It varied from 0.1 – 9.9 ppm at all stages of plant species.

ANOVA explained that variations of sodium contents in all tested plants are significant while it is highly significant at phenological stages.

The results revealed that sodium content was found very low in all plant species. The maximum content was found in *Rumex dentatus.* It is associated with body fluid and regulates acid base balance. It is a major electrolyte of blood and help in hydration (Ayoola, 2010; Gbolahan, 2010). Its intake is related with hypertension in human. James *et al.*(2010) determined highest level of sodium in all parts of *Saba florida.* It has been proved (Hussain *et al.*, 2010) significant level of sodium in *Dalbergia sisso.* Adnan *et al.*(2010) identified low level of sodium in *Bupleurum falcatum.* They also mentioned that *Otostegia lambata* show much increase in Sodium concentration. Hanif *et al.* (2006) found maximum amount of sodium in reddish (63.9 ppm) while low level found in bottle

gourd(1.7 ppm). The present study revealed that sodium was low in concentration due to the climate conditions and soil physiochemical properties.

Macro Elements

Macro nutrients are those that are required in relatively high levels. They may be divided into two subgroups i.e. major macro nutrients and secondary macronutrients. The major macronutrients included Phosphorus and Potassium.

1. **Major Macro Nutrients**

Phosphorus (P)

Phosphorus is an important element of the plant body and is required in various functions. It is recorded maximum in *Fimbristylys squarrosa* (396.8 ppm) followed by *Hypericum (*17.4 ppm) and *Rumex dentatus* (161.4 ppm) in vegetative stage (Fig.13). It ranges from 2.18 ppm (*Brachiaria reptens*) to 39.8 ppm (*Fimbristylys squarrosa*) in vegetative stage. The *Bromus pectinatus* and *Rumex dentatus* had non significant values of phosphorus in reproductive stage. *Setaria viridis* (17.329 ppm) and *Rumex hastatus* (13.478 ppm) have the maximum content in reproductive stage. Similarly *Rumex dentatus* (9.94 ppm) and *Setaria viridis* (6.86 ppm) have higher content of phosphorus and *Amaranthus viridis* (0.86 ppm) and *Bromus glomerata* (0.9 ppm) have low concentration in post reproductive stage (Table 3). It varied from 2.2 – 396 ppm in vegetative stage, 0.7 – 13.5 ppm in reproductive stage and 0.9 – 9.9 ppm in post reproductive stage. The maximum average ranged 1.0 to 141.9 ppm. The highest average content of phosphorus was recorded in *Fimbristylys squarrosa* (133.0 ppm) and lowest average content was found in *Brachiaria reptens* (4.7 ppm). Similarly, the minimum average of phosphorus was found in post reproductive stage (3.5 ppm), followed by reproductive stage (5.4 ppm) and vegetative stage (354.2 ppm). It is obvious from the averaged values that as plant grow the phosphorus content decreases. Two tested species i.e. *Bromus pectinatus* and *Rumex dentatus* missing phosphorus in reproductive stage while present in other stages.

The ANOVA showed that the variance is highly significant among the plants species and is only significant between different stages.

The results revealed that *Brachiaria reptens* had the lowest average content of phosphorus and *Fimbristylys squarrosa* had the highest average. Adenipekun & Oyetunji

(2010) investigated higher content of phosphorus in *Vigna unguiculata.* Bano *et al.*(2009) reported phosphorus content was significantly higher in spring and lower in early summer. Rahim *et al.* (2008) stated that phosphorus content increased with age in marginal grasses. Our results do not agree with their ones. Cheema *et al.* (2011) stated that it varied from 0.09 % to 0.57 % in *Morus alba.* Saha & Gupta (1987) described the tree leaves had low content of phosphorus. Iqbal *et al.* (1999) revealed that phosphorus is non significant in leaves of Kinnow and varied from 0.0117 – 0.150 %. Hanif *et al.*(2006) stated that phosphorus is the second abundant macro element in vegetables. These results are similar to us. Hameed *et al.*(2008) also reported phosphorus in leaves of *Rumex hastatus* and was highest. Their results supported our results.

Potassium (K)

Potassium content at all phonological stages are lower as compared to other elements. However the lowest average is present in post reproductive stage (3.5 ppm). The lowest concentration is present in *Amaranthus viridis* (0.86 ppm) followed by *Bromus glomerata* (0.9 ppm) in post reproductive stage (Table 3). *Bromus glomerata* has also the lowest content of Potassium in vegetative stage (Table 1).

The maximum content is present in *Rumex dentatus* (10.04 ppm) and 9.94ppm in vegetative stage, 1.52 ppm to 9.6 ppm in reproductive stage and 0.86 ppm to 9.994 ppm in post reproductive stage (Fig.11). Potassium content varied from 0.9 ppm to 10 ppm with average of 4.6 ppm in vegetative stage, 1.5 ppm to 9.6 ppm with average 4.3 ppm in reproductive stage and post reproductive stage varied with average of 3.5 ppm. It is evident that potassium concentration also decreases with age (Table 1.2). The highest average of potassium was recorded in *Rumex dentatus* (8.4 ppm) and lowest recorded for *Bromus glomerata* (1.1 ppm).

The ANOVA indicated that variance between plant species was highly significant and was significant in phenological stages.

The results revealed that *Bromus glomerata* had the lowest content of potassium at all its three phenological stages. It was highest in two phenological stages of *Rumex dentatus.* Hameed *et al.* (2008) stated that potassium was absent in the flowers of *Rumex hastatus.* They investigated potassium in members of polygonaceae that varied 1.04 ppm to 6.57 ppm. Their findings support our results. Saidu & Jideobi (2009) and Zafar

et al. (2010) also supported our findings. Sultan *et al.*(2008) stated that potassium content in free grazing lands was higher at early bloom than at maturity. But they stated that potassium increases with maturity which is not coinciding with our findings. Minson (1990) said that K content is lowered in grasses of rangelands than pasture herbs. Potassium are important to activate enzymes which affect the plant growth, development and structure (Sultan *et al.* 2008; Sultan *et al.* 2007; Hussain & Durrani, 2007; Khan *et al.* 2007).

2. Secondary Macronutrients

Calcium and Magnesium are considered secondary macronutrients.

Calcium

Generally, the calcium contents are recorded high in the all phenological stages of the tested plants. The maximum Ca is present in *Polygonum glabrum* in its all phonological stages i.e. 620 ppm, 242.6 ppm and 274.6 ppm in post reproductive, vegetative stage and reproductive stage, respectively. The least amount were found in *Hypericum perforatum* (6 ppm) in reproductive stage followed by *Bromus glomerata* (6.2 ppm) in vegetative stage. Across the species and phenological stages the lowest average concentration (112.9 ppm) was present in reproductive stage while the highest average contents (138.4 ppm) was recorded in post reproductive stage (Fig. 9). The lowest average was registered in *Fimbristylys squarrosa* (32.4 ppm) while the maximum average was recorded in *Brachiaria reptens* (194.5 ppm). The lowest average was determined for reproductive stage (112.9 ppm) in all tested plants followed by vegetative state (123.7 ppm). Post reproductive stage had the maximum average content of calcium (138.4 ppm). The ANOVA showed the variance is highly significant between the plants and was non significant between phenological stages.

It can be observed from the data in table 1.2, that non palatable plant *Polygonum glabrum* and *Artemisia scentifolia* had the higher content of Ca. Zafar *et al.*(2010) described that Ca contents were present invariably in plants. Hammed *et al.* (2008) also investigated Ca in *Polygonum plebejum, Rumex hastatus, Rumex dentatus* and *Rumex nepalensisi.* It ranged from 0.99 to 7.68 ppm. Our results showed that these species had 70.7 ppm and 137.3 ppm in *Rumex dentatus, Rumex hastatus,* respectively. Hanif *et al.*(2006) found Ca high in spinach (76 ppm) while recorded low in potato (8 ppm). This

range of Ca content agreed with our findings. Hussain *et al.*(2009) found higher concentration of Ca in *Hypericum perforatum* (192 ppm). We investigated Ca (55 ppm) an average which is lower than former investigation. WHO proposed the daily intake of Ca 450 – 1200mg which is an agreement with *Polygonum glabrum.* James *et al.*(2010) also reported higher Ca level in *Saba florida.* Bano *et al.*(2009) determined Ca in *Chrysopogon aucheri* and *Cymbopogon jwarancusa.* Khan *et al.* (2009) also reported seasonal effect on Ca in plants. Hussain *et al.* (2010) stated that plants provide 25 % of Ca in food. They had higher concentration among all vegetables in *Trianthema portulacstrum.*

Magnesium (Mg)

Generally, the maximum average (46.0 ppm) content of Mg was recorded in reproductive stages followed by post reproductive stage with average of 37.7 ppm. Among the species the highest contents was found in reproductive stage of *Cenchrus ciliaris* (136.4 ppm) followed by *Amaranthus viridis* 78.38 ppm and 72.24 ppm in vegetative and reproductive stages respectively. *Polygonum glabrum* and *Fimbristylys squarrosa* each had 71.54 ppm in post reproductive stage (Fig.10). The lower contents were recorded in *Bromus glomerata* (7.98 ppm) and *Fimbristylys squarrosa* (12 ppm) in vegetative stage. *Setaria viridis* and *Bromus pectinatus*, each had 14.3 ppm in post reproductive stage. It was obvious that Mg contents were lower in vegetative stages (Table 1) among the species. The average content of Mg varied from 35.3 ppm to 46 ppm with average of 39.7 ppm. The lowest average recorded for *Artemisia scentifolia* (22 ppm) and highest for *Amaranthus viridis* (61.6 ppm).

The statistical analysis by ANOVA without replication showed that variation among the different tested species was significant and between the different phenological stages was also significant.

The results revealed that Mg varied with average from 35.3 ppm in vegetative stage to 46 ppm in reproductive stage. Magnesium concentration was determined 0.72 (*Morus alba),* 0.84 % (*Acacia nilotica),* 0.54 % (*Zizypus jujuba).* Rahim *et al.*(2008) showed that Mg contents decreases with the maturity of plants. These findings also support our results that Mg contents increased to the maturity stage and then declined in the post mature stage. It also supported the findings of Skerman & Riveros (1990) who

described Mg content declined in leaf and stem with age. Its deficiency pronounced in acid, deficient with Mg and sandy soil. Availability of Ca and Mg in soil affect the intake of Mg by the plants (Skerman & Riveros, 1990; Rahim *et al.*, 2008). Georgieviskii (1982) revealed equal amount of Mg in leaves and stem. Its uptake was generally low at low temperature and water logged soil. The grazing pastures had usually higher contents of Mg (ARC, 1980; Islam *et al.*, 2003; Khan *et al.*, 2006). The tested species had higher level of Mg than recommended values and therefore these forages are good for lactating cattle, goat and sheep. Dua & Care (1995) stated that availability of Mg to cattle is affected by other dietary components like K, N, Ca.

Heavy Elements

Lead (Pb)

Lead is an important, poisonous and heavy in nature. Fig. 7 and Table 1, 2 and 3 show that the highest concentration of lead was present in *Fimbristylys squarrosa* (786 ppm) followed by *Brachiaria reptens* (614 ppm) in post reproductive stage.

The vegetative stage has lead content in range of 34 ppm (*Brachiaria reptens*) to 238 ppm (*Bromus glomerata*). *Rumex dentatus, Solanum nigrum, Ajuga bracteosa,* and *Amaranthus viridis* missing lead in vegetative stage while *Hypericum perforatum* and *Bromus glomerata* had no considerable level at pre mature stage. Lead ranges from 12.4 ppm (*Polygonum glabrum*) to 480 ppm (*Rumex dentatus)* in reproductive stage. *Brachiaria reptens, Fimbristylys squarrosa, Rumex hastatus, Hypericum perforatum, Solanum nigrum* had also missed lead content. The maximum concentration is measured in *Fimbristylys squarrosa* (786 ppm), followed by *Brachiaria reptens.* Nine species among the tested, missing Pb at post reproductive stage. It varied from 12.4 ppm to 786 ppm in all investigated species. The lowest average was recorded for vegetative stage (95.7 ppm) and then reproductive stage with highest average of 172.6 ppm. *Solanum nigrum* is the only species collected from Gumrush hills at height of 4500 ft had absent Pb at all phenological stages (table 1.3). The highest average was noted for *Fimbristylys squarrosa* (309.3 ppm) which had made this species non palatable and is not attracted by the animals.

Statistical analysis of ANOVA showed that there is not significant variation among the plants of different phenological stages.

Lead is a pollutant emitted from various sources. It is non degradable and easily enters food chain. It had gained potent attention due to anthropogenic pressure on vegetation and environment. It is absorbed by the roots and then transport to various organs, however, its transport is checked by the cells of endodermis. A number of disorders caused due to its presence in plant body. It interferes with the enzymatic activity, growth and chlorosis. It decreases the rate of photosynthesis and destroy the structure of chloroplasts (Senger *et al.,* 2008). It is toxic and accumulative element (Horsefall & Spiff, 2005). Naturally Pb found less than 50 ppm in soil but contaminated soil may contain more than 11000 mg/kg (Oancea & Airinei, 2010). It is an important element for plants. The plants easily absorbed and accumulated it which is regulated by pH, cations, and soil particle sizes. Our finding support the review of Zafar *et al.,* 2010; Adnan *et al.,* 2010; Hussain *et al.,* 2010a, Hussain *et al.,* 2010b, Hussain *et al.,* 2010c, ; Rehman *et al.,* 2008; James *et al.,* 2010.

Cadmium

The range of Cd varied from 1.6 to 15.8 ppm in vegetative stage, 1.2 to 16.2 ppm in reproductive stage and 5.4 to 35.8 ppm in post reproductive stage (Table 1, 2, 3). It should have a tendency of increase toward maturity. Fig. 6 depicts that 8 plants had negligible values of Cd in post reproductive stage followed by 5 plants in reproductive stage and 4 in vegetative stage. The highest accumulation was recorded in *Polygonum glabrum* (35.8 ppm) followed by *Artemisia scentifolia* (16.8 ppm) in post reproductive stage. The lowest average of Cd was found in reproductive stage (4.4 ppm) in these plants (Fig.6). Table 1.3 depicts that lowest average of Cd content was found in reproductive stage followed by vegetative stage. *Fimbristylys squarrosa* and *Rumex hastatus* had missed the Cd contents in its all phenological stages. Tested species had missed Cd mostly in post reproductive stage followed by reproductive and then vegetative stage.

The results revealed the *Artemisia scentifolia* had higher content of Cd while all other plants had lower contents. Cd contents occurred in these plants higher than the proposed values of WHO 0.06-0.07 mg/day (FAO, 1993).

Chromium (Cr)

The maximum concentration of Cr was recorded in *Brachiaria reptens* (420 ppm) followed by *Bromus pectinatus* (156 ppm) in reproductive stage. The vegetative stage of *Artemisia scentifolia* had the highest Cr content (96 ppm) followed by *Polygonum glabrum* (82 ppm) and *Rumex dentatus* (80 ppm) (Table 1). At post reproductive stage *Brachiaria reptens* (88 ppm) had the highest content followed by the *Rumex dentatus* (44ppm) and *Ajuga bracteosa* (42 ppm) (Table 2 & 3). *Rumex hastatus* (4ppm) had the lowest Cr level in post reproductive stage and *Cenchrus ciliaris* (6 ppm) had in vegetative stage and *Hypericum perforatum* (8 ppm) in reproductive stage.

Generally, the post reproductive stage had the lowest level across the species with average of 15.9 ppm and 30.4 ppm in vegetative stages. The reproductive stages had the highest average value of Cr (72.7 ppm) among the species.

The results revealed that the lowest average was recorded for post reproductive stage (15.9 ppm) that depicts the Cr content decreases with the maturity of plants. The highest average was investigated for reproductive stage (72.7 ppm). Seven species lacking Cr at post reproductive stage and vegetative stage while only two species missed it in reproductive stage.

ANOVA showed that variance between the plant species were highly significant while it is significant between phenological stages.

Cr is also toxic and non essential element for plants and microorganisms. Hussain *et al.* (2010) investigated very low content of Cr in *Hypericum perforatum.* Our findings also showed the similar results in this plant. Zafar *et al.* (2010) also determined Cr in some medicinal plants used in traditional medicine. The results are in range given by Haward *et al.* (1962) and Bors & Jasper (1992). Our findings also similar to the following reviews. Hussain *et al.*(2010a); Ahmad *et al.*(2009); Zafar *et al.*(2010b); Adnan *et al.*(2010); Rehman *et al.*(2008); Hussain *et al.*(2010).

Fig. 1. Copper contents (ppm) of forage plants at three phenological stages.

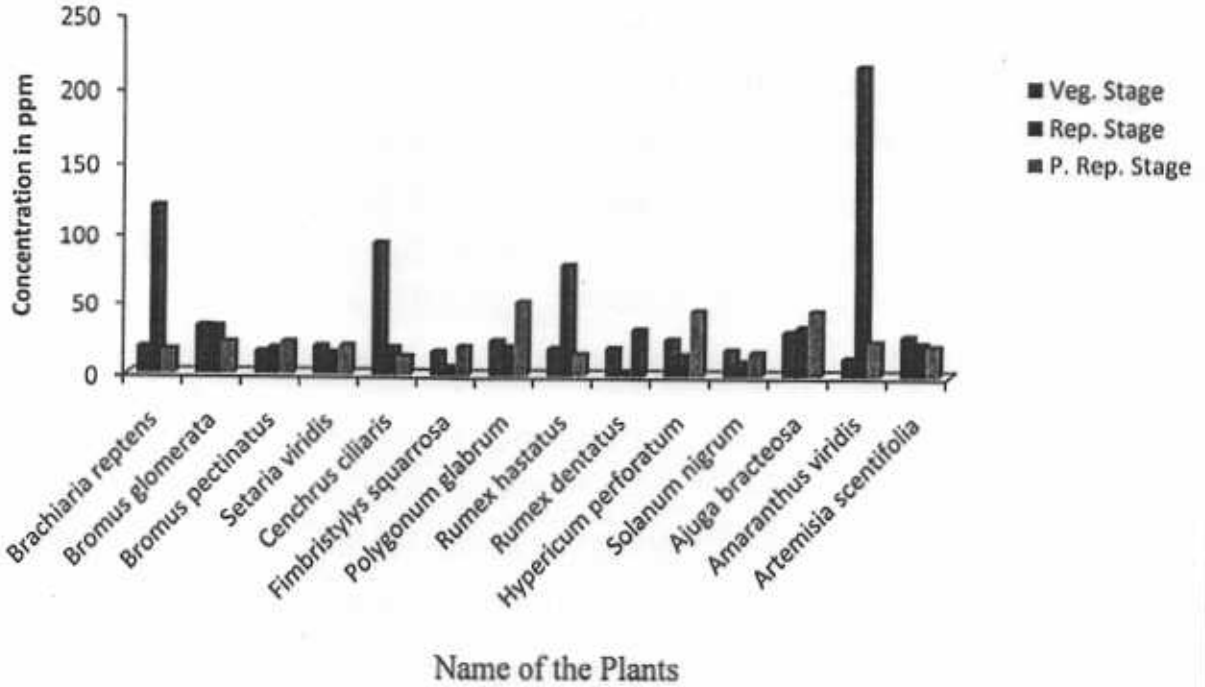


Fig. 2. Zinc contents (ppm) of forage plants at three phenological stages.

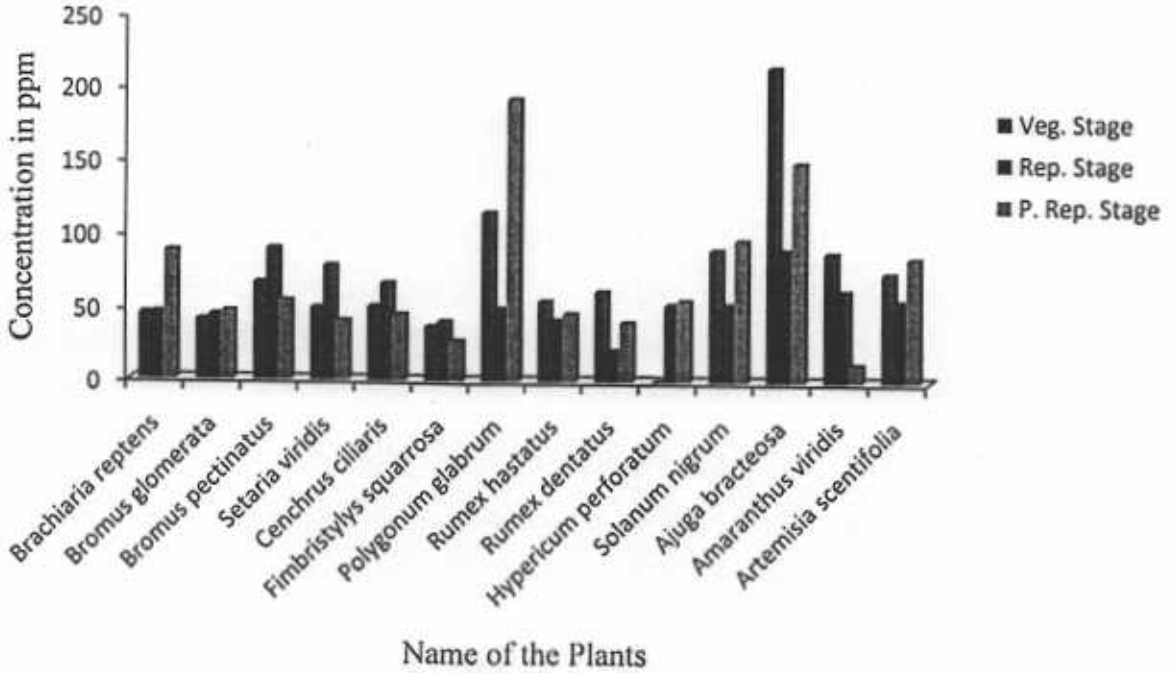


Fig. 3. Iron contents (ppm) of forage plants at three phenological stages.

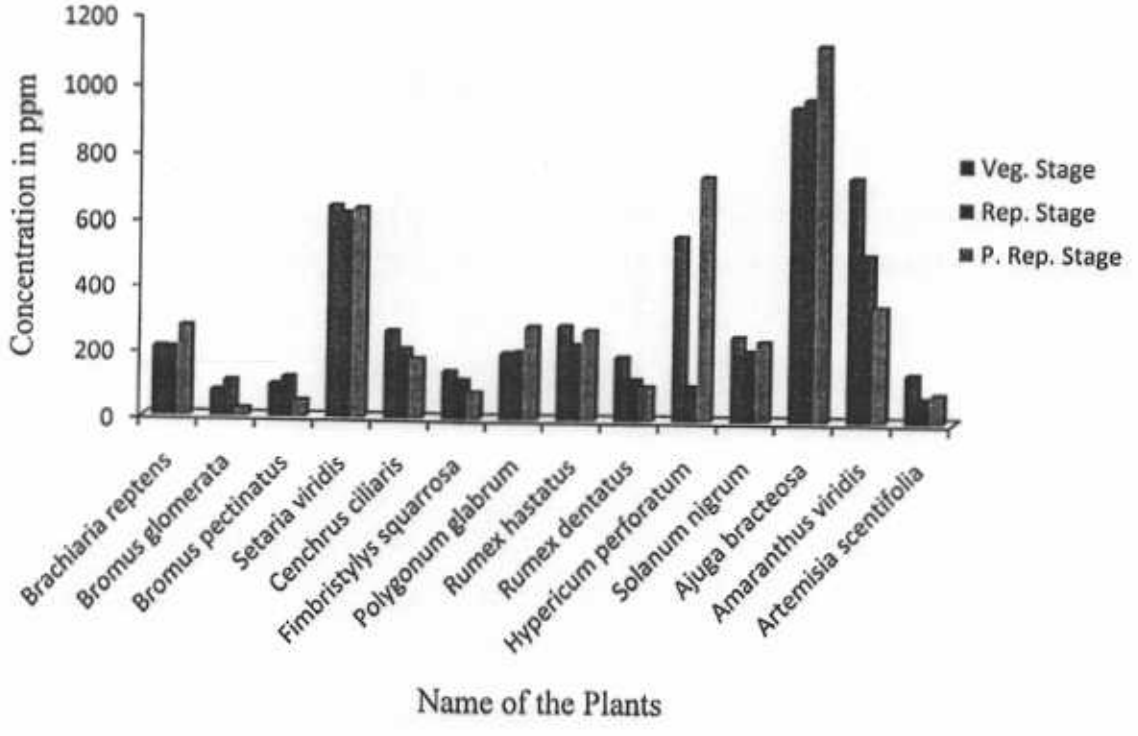


Fig. 4. Manganese contents (ppm) of forage species at three phenological stages.

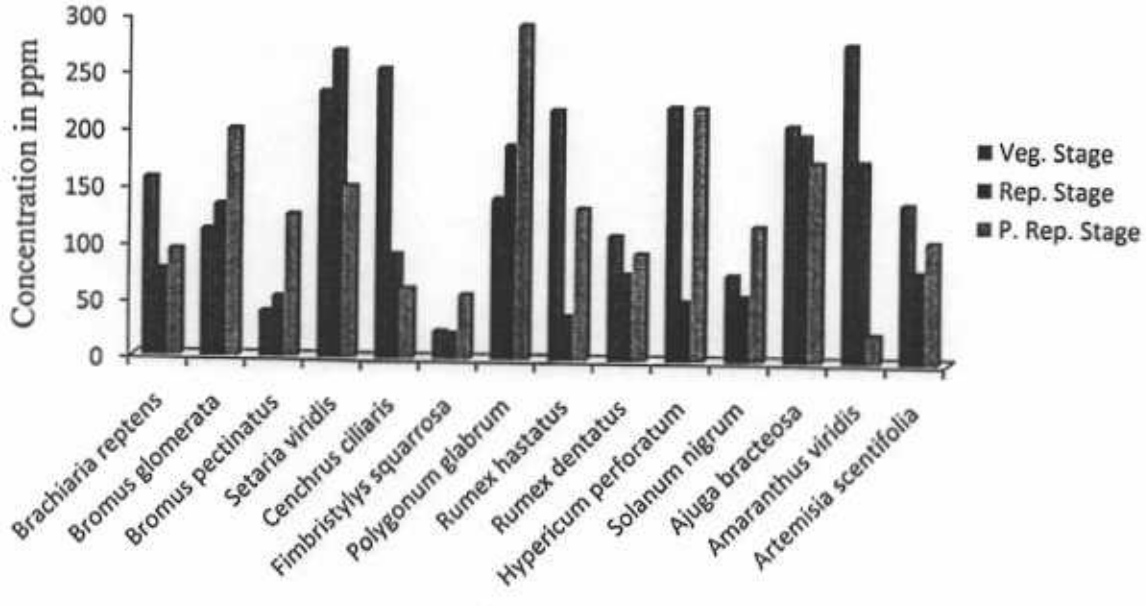


Fig. 5. Nickle contents (ppm) of forage plants at three phenological stages.

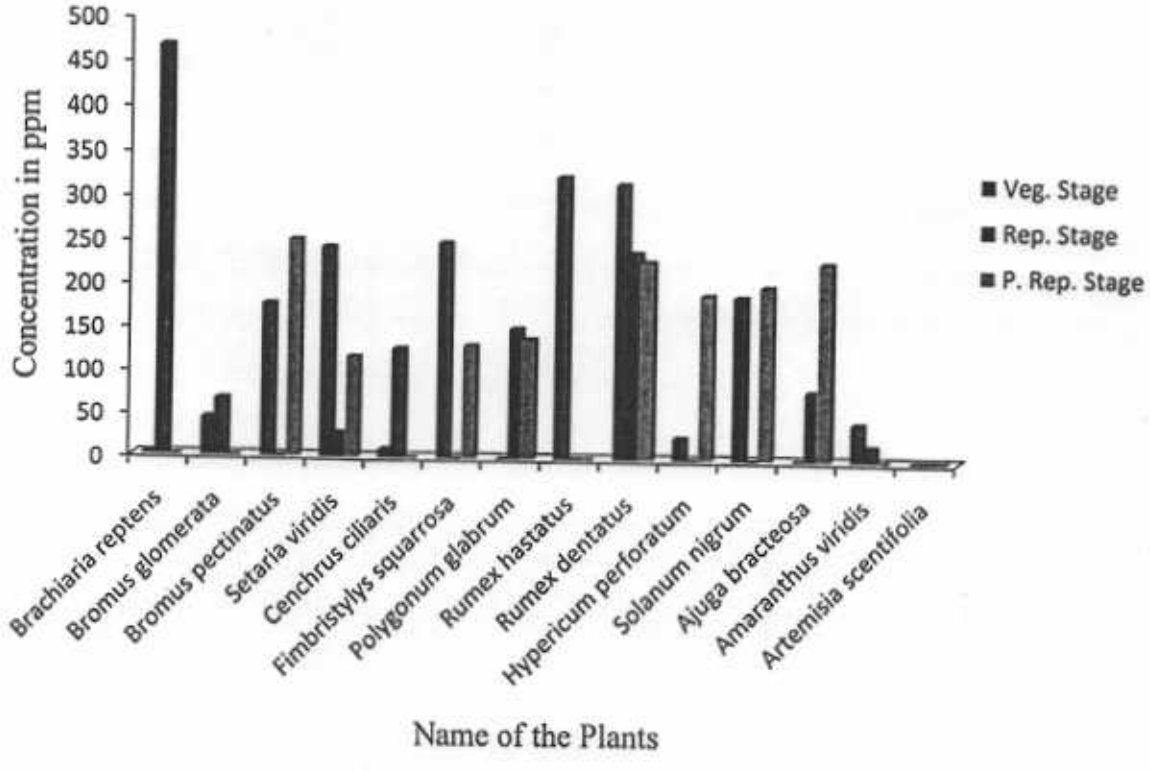


Fig. 6. Cadmium contents (ppm) of forage species at three phenological stages.

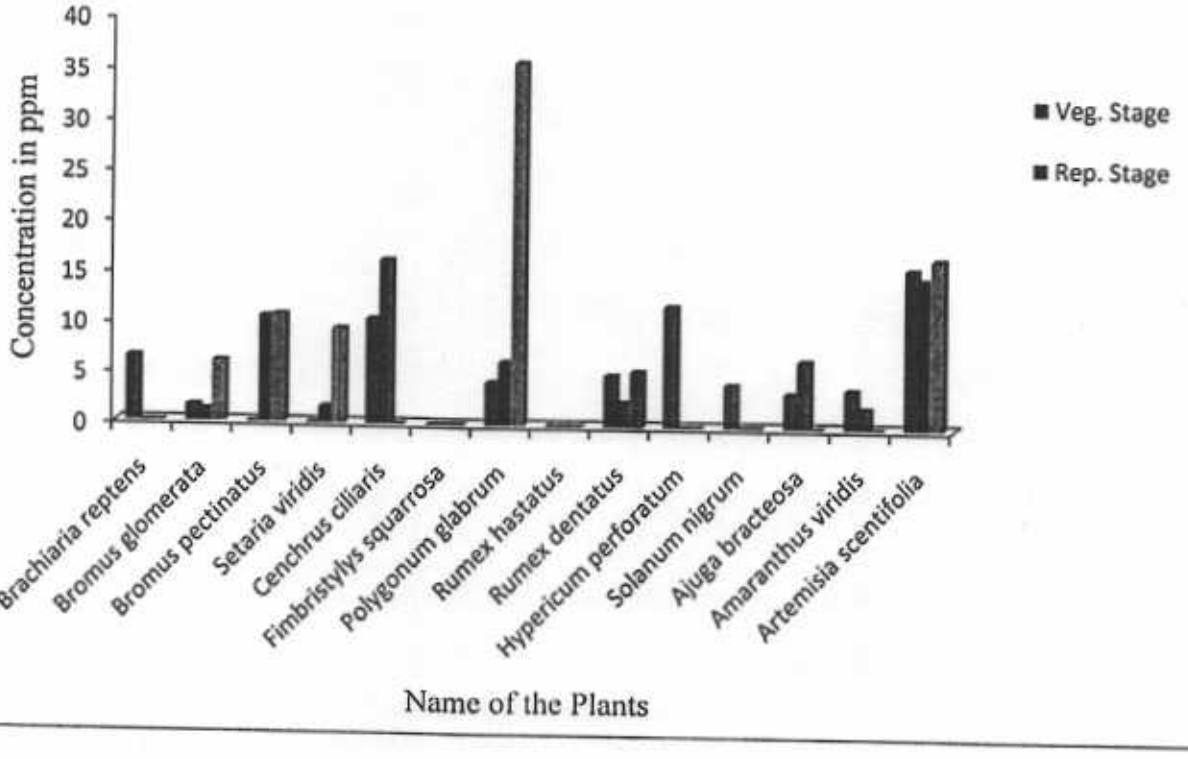


Fig. 7. Lead contents (ppm) of forage plants at three phenological stages.

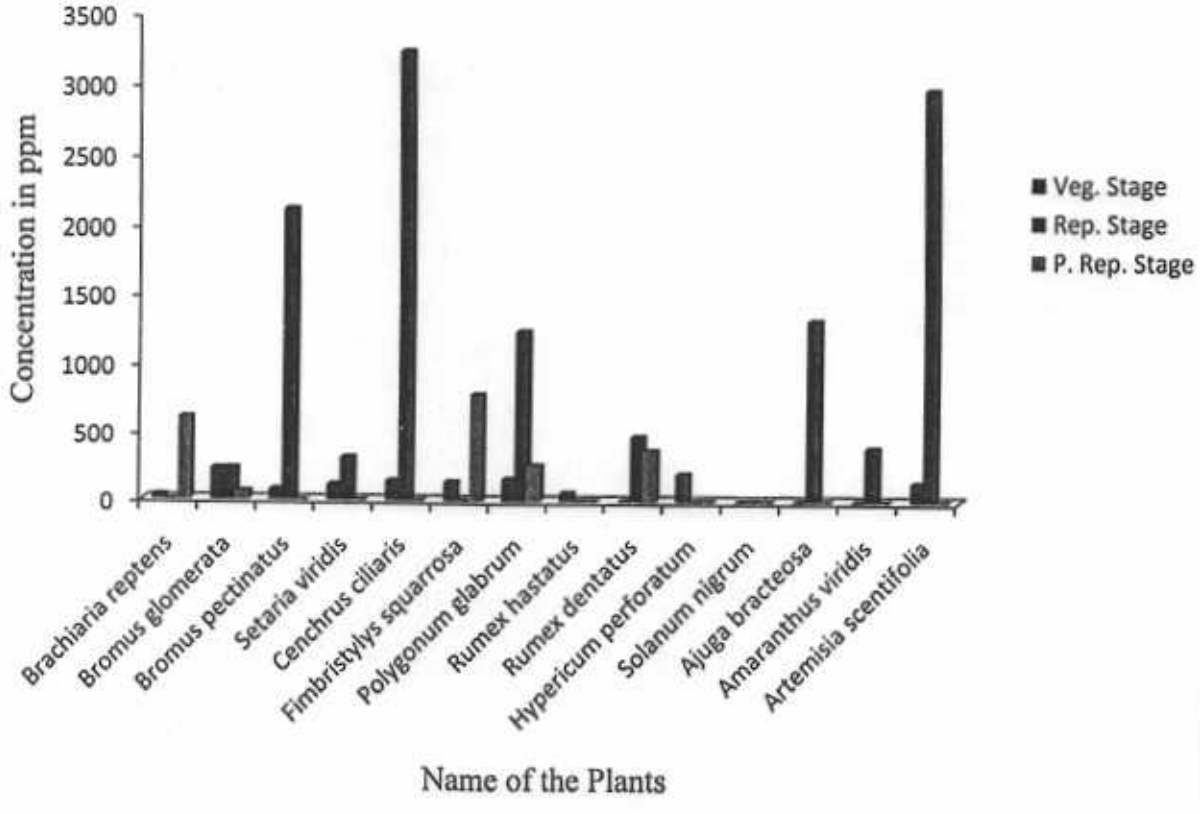


Fig. 8. Chromium contents (ppm) of forage species at three phenological stages.

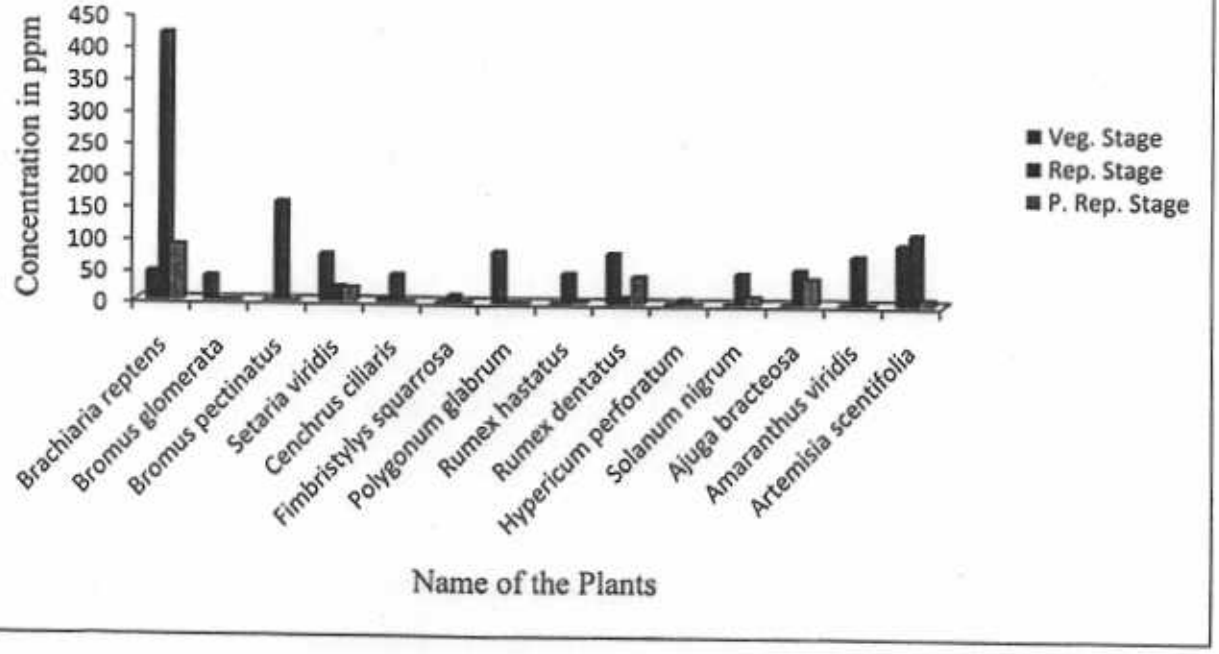


Fig. 9. Calcium contents (ppm) of forage plants at three phenological stages.

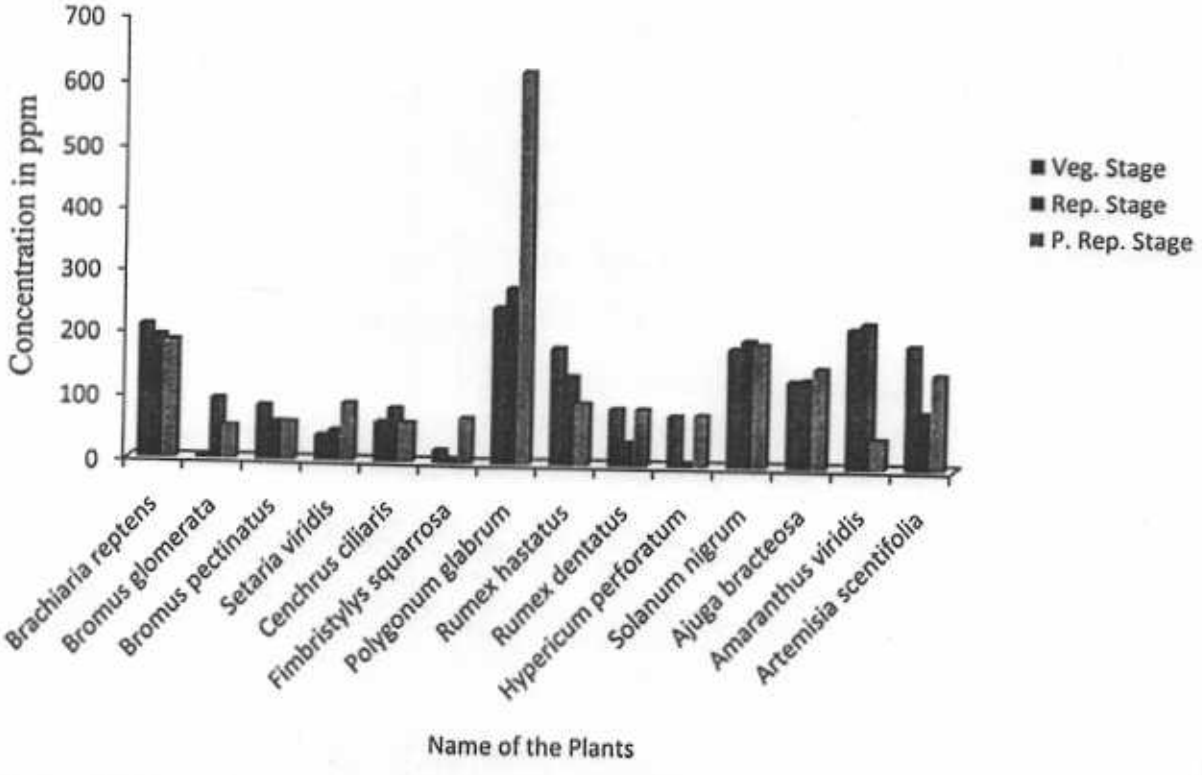


Fig. 10. Magnesium contents (ppm) of forage species at three phenological stages.

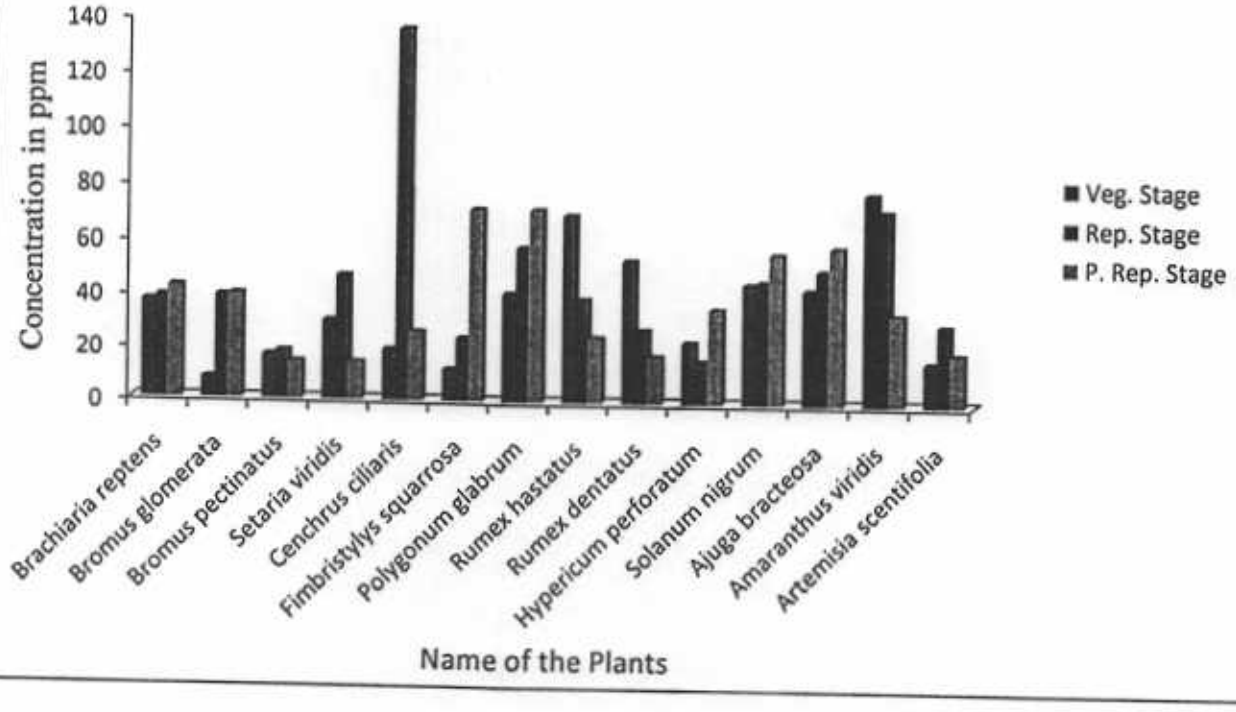


Fig. 11. Potassium contents (ppm) of forage species at three phenological stages.

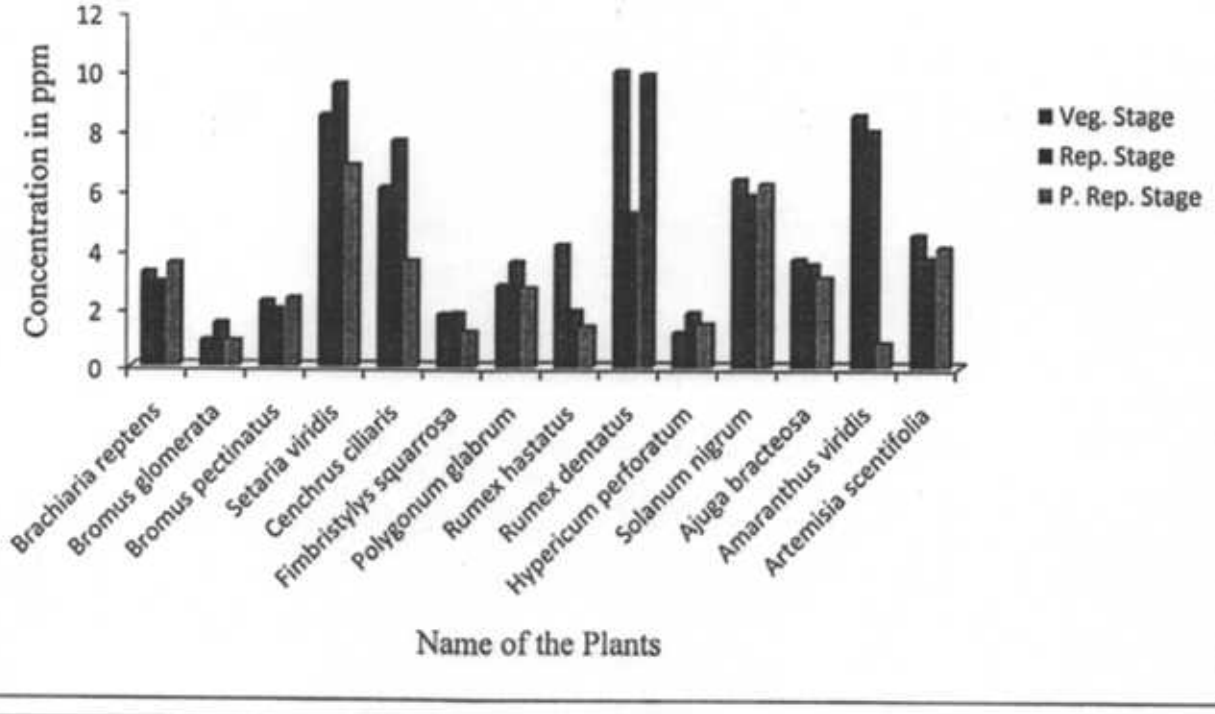


Fig. 12. Sodium contents (ppm) of forage species at three phenological stages.

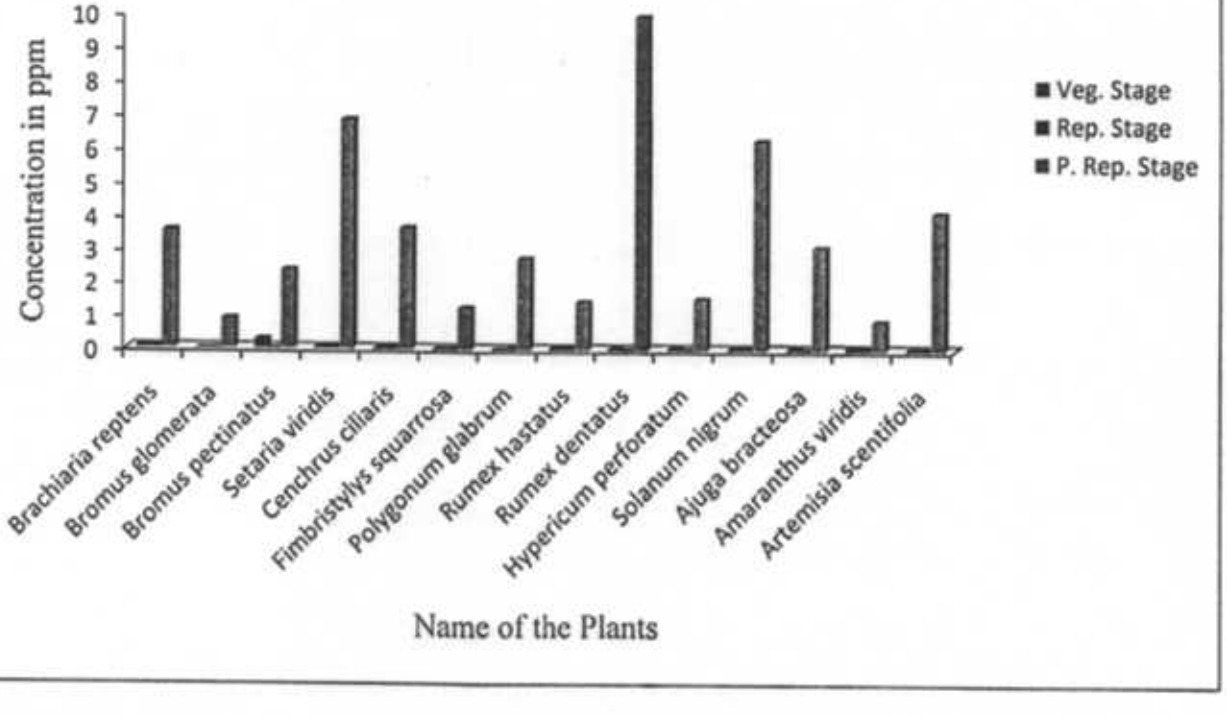


Fig. 13. Phosphorus contents (ppm) of forage species at three phenological stages.

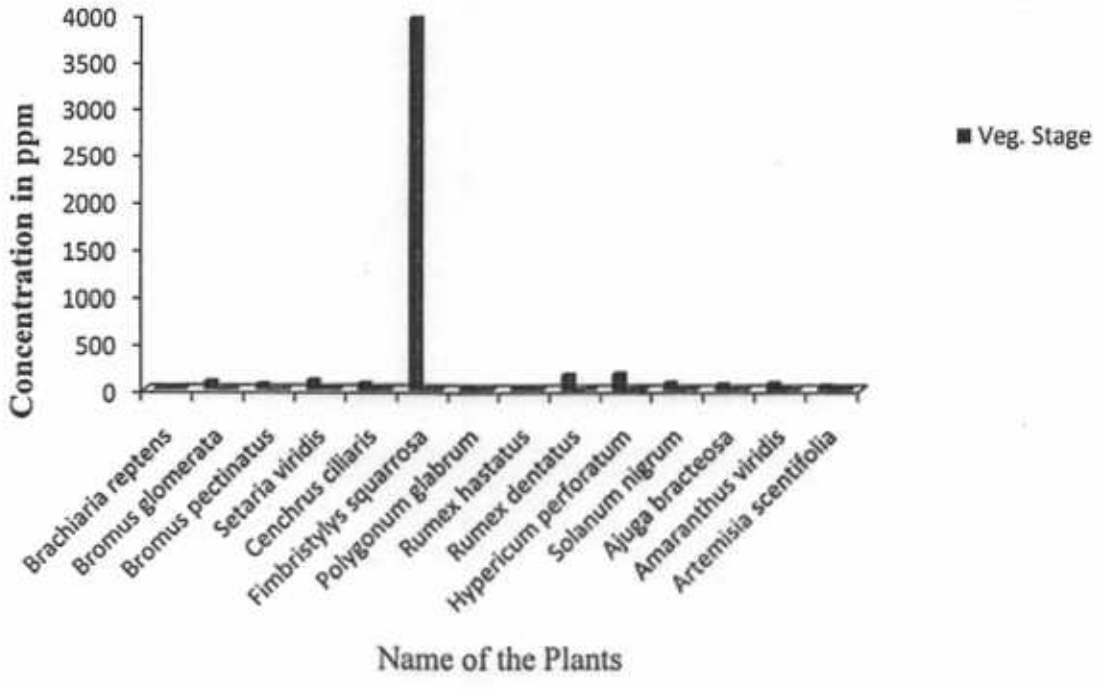


Fig. 7.1. Comparison of vegetative stages of different micronutrients in selected plants of Chakesar Valley.

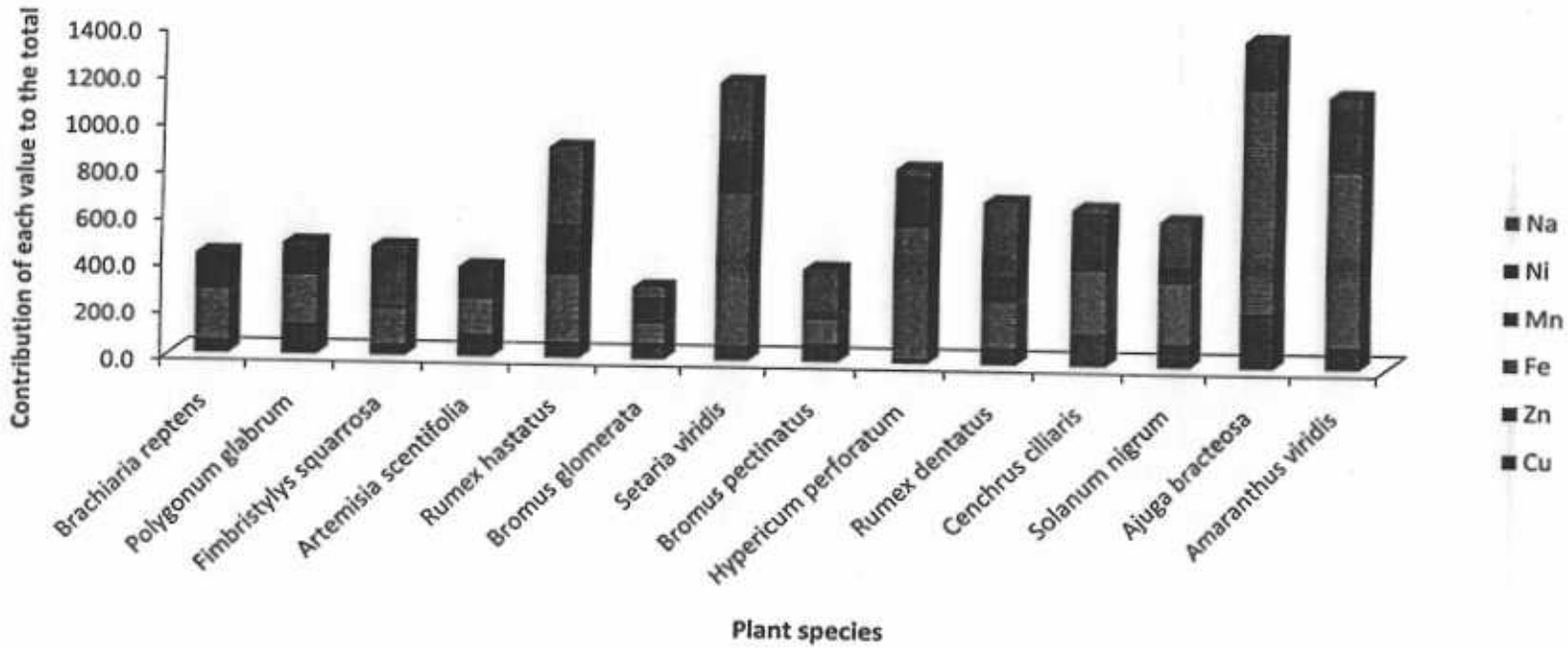


Fig. 7.2 Comparison of reproductive stages of different micronutrients in selected plants of Chakesar Valley.

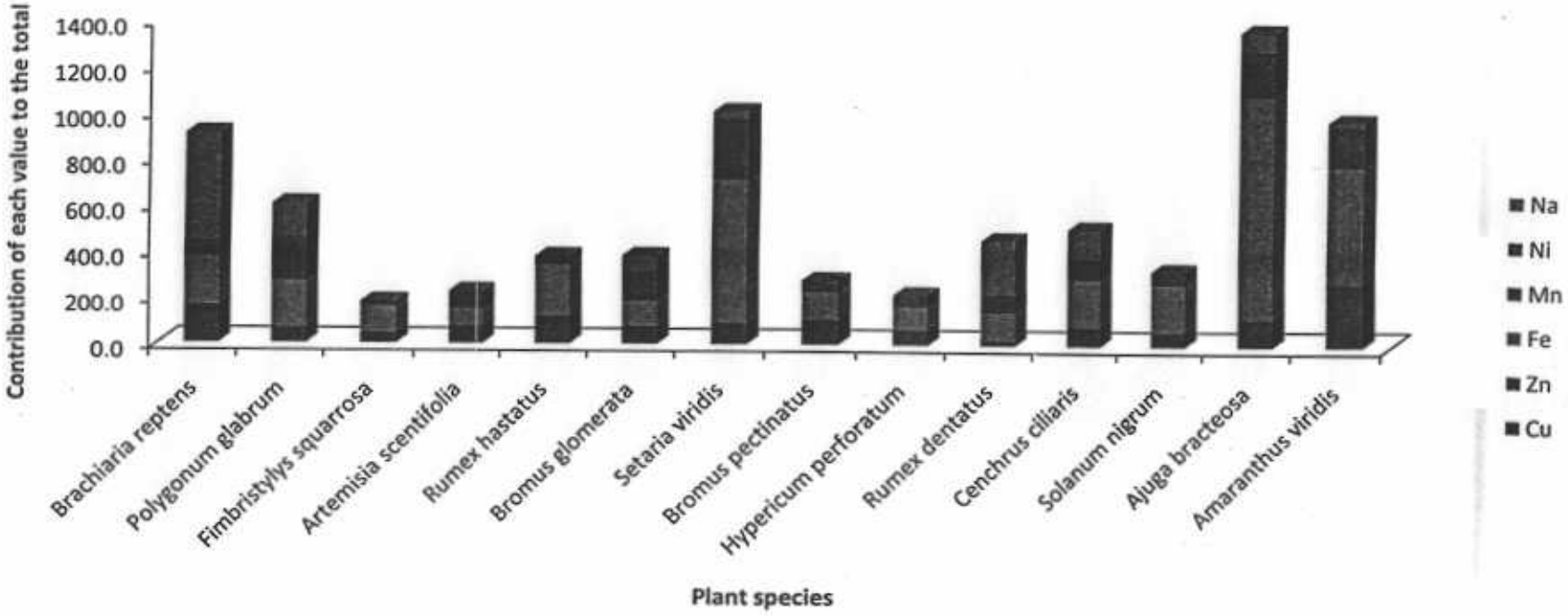


Fig. 7.3 Comparison of post reproductive stages of different micronutrients in the selected plants of Chakesar Valley.

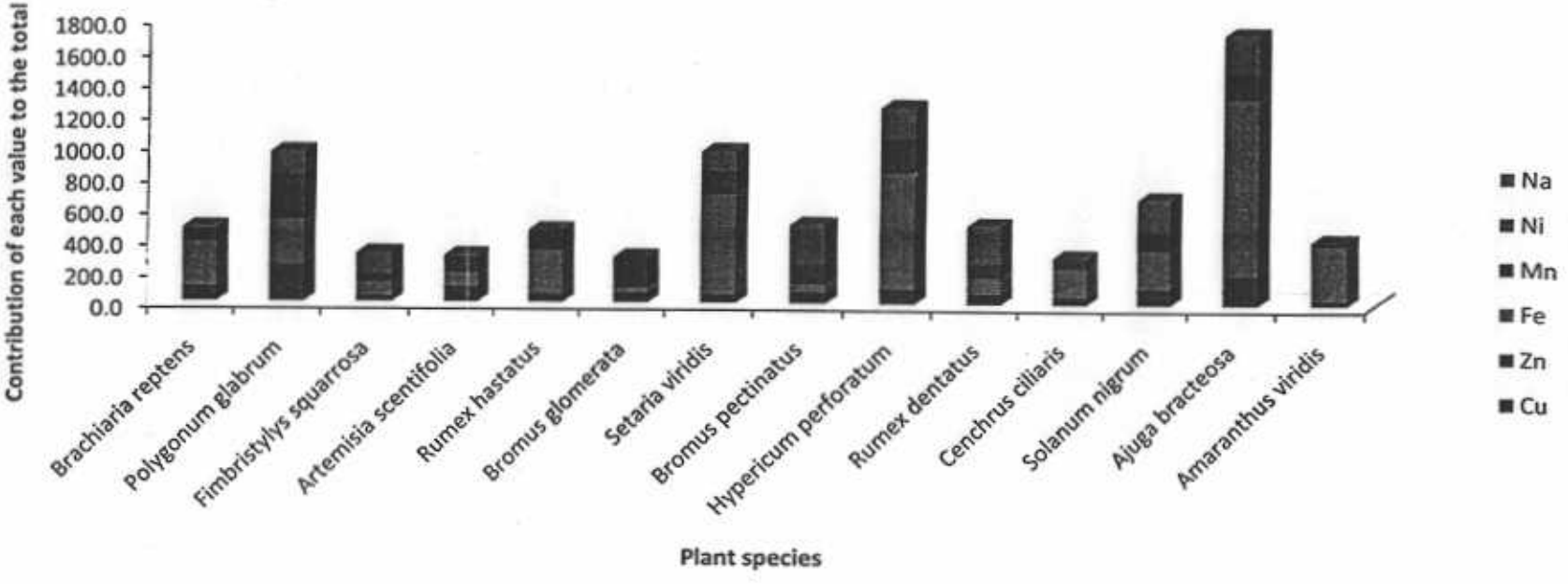


Table 6.1 Concentration gradient of micro elements of some medicinal plants at their three phenological stages of Chakesar Valley, Shangla.

No	Name of the plants	Cu				Zn				Fe				Mn				Ni				Na			
		Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg
1	*Brachiaria reptens*	18.2	120	16.4	51.5	46.0	46.6	88.6	60.4	208.4	206.0	273.6	229.3	156.8	77.0	94.6	109.5	2.0	466.0	0.0	156.0	0.1	0.0	3.6	1.2
2	*Polygonum glabrum*	23.6	19.4	51.2	31.4	115.4	50.2	192.6	119.4	198.0	202.0	280.8	226.9	142.0	188.8	294.6	208.5	0.0	150.0	138.0	96.0	0.0	0.0	2.7	0.9
3	*Fimbristylys squarrosa*	16.0	5.8	19.6	13.8	37.8	41.4	28.0	35.7	142.2	116.4	79.8	112.8	24.8	22.6	57.2	34.9	248.0	0.0	130.0	126.0	0.0	0.0	1.2	0.4
4	*Artemisia scentifolia*	27.2	22.2	20.4	23.3	74.8	55.8	85.0	71.9	143.6	72.2	85.2	100.3	140.8	81.0	108.0	109.9	0.0	0.0	0.0	0.0	0.0	0.0	4.1	1.4
5	*Rumex hastatus*	18.4	78.0	14.4	36.9	55.4	42.4	47.0	48.3	283.4	225.0	270.0	259.5	219.8	38.8	134.4	131.0	324.0	0.0	0.0	108.0	0.1	0.1	1.4	0.5
6	*Bromus glomerata*	33.4	33.0	21.6	29.3	42.0	45.4	47.6	45.0	78.6	108.0	23.8	70.1	112.6	134.4	200.6	149.2	44.0	66.0	0.0	36.7	0.0	0.0	0.9	0.3
7	*Setaria viridis*	19.4	15.0	19.8	18.1	50.4	78.8	41.2	56.8	642.4	622.2	636.6	633.7	234.0	270.6	151.6	218.7	242.0	28.0	116.0	128.7	0.1	0.1	6.9	2.3
8	*Bromus pectinatus*	15.4	18.0	22.2	18.5	67.4	90.4	55.0	70.9	98.2	120.4	50.2	89.6	40.2	54.0	126.2	73.5	176.0	0.0	250.0	142.0	0.3	0.0	2.4	0.9
9	*Hypericum perforatum*	24.6	14.0	45.0	27.9	0.0	53.0	56.0	36.3	558.0	102.0	739.6	466.5	223.4	53.0	223.0	166.5	26.0	0.0	190.0	72.0	0.0	0.0	1.5	0.5
10	*Rumex dentatus*	18.6	3.0	31.4	17.7	62.0	21.6	41.0	41.5	189.6	121.4	100.0	137.0	110.6	77.0	95.2	94.3	316.0	238.0	228.0	260.7	0.0	0.0	9.9	3.3
11	*Cenchrus ciliaris*	93.8	18.6	12.6	41.7	51.4	67.2	46.0	54.9	262.4	207.0	178.6	216.0	255.0	92.8	62.6	136.8	10.0	126.0	0.0	45.3	0.0	0.0	3.7	1.2
12	*Solanum nigrum*	17.4	9.6	15.8	14.3	90.2	53.2	96.8	80.1	253.2	208.8	238.6	233.5	76.6	57.6	119.8	84.7	188.0	0.0	200.0	129.3	0.0	0.0	6.3	2.1
13	*Ajuga bracteosa*	29.8	33.2	44.8	35.9	214.6	90.2	149.2	151.3	944.8	968.0	1125	1013	208.2	199.6	176.2	194.7	0.0	80.0	228.0	102.7	0.0	0.0	3.1	1.0
14	*Amaranthus viridis*	12.0	216	23.2	83.7	88.2	62.6	12.4	54.4	740.2	506.6	347.6	531.5	279.8	177.4	25.2	160.8	44.0	18.0	0.0	20.7	0.1	0.1	0.9	0.3
Maximum		93.8	216	51.2	83.7	214.6	90.4	192.6	151.3	944.8	968.0	1125	1013	279.8	270.6	294.6	218.7	324.0	466.0	250.0	260.7	0.3	0.1	9.9	3.3
Minimum		12.0	3.0	12.6	13.8	0.0	21.6	12.4	35.7	78.6	72.2	23.8	70.1	24.8	22.6	25.2	34.9	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.3
Average		26.3	43.3	25.6	31.7	71.1	57.1	70.5	66.2	338.8	270.4	316.4	308.5	158.9	108.9	133.5	133.8	115.7	83.7	105.7	101.7	0.1	0.0	3.5	1.2

Key Note: Veg = Vegetative stage, Rep = Reproductive stage, P.Rep = Post reproductive stage

Table.6.2 Concentration gradient of Major and Secondary Macronutrients of some medicinal plants at their three phenologiy

No	Name of the plants	Major Macro Nutrients								Secondary Macro Nutrients							
		P				K				Ca				Mg			
		Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg
1	*Brachiaria reptens*	2.2	8.2	3.6	4.7	3.3	2.9	3.6	3.3	208.0	191.8	183.8	194.5	37.0	38.8	42.8	39.5
2	*Polygonum glabrum*	39.4	2.2	2.7	14.8	2.8	3.6	2.7	3.1	242.6	274.6	620.4	379.2	41.1	58.1	71.5	56.9
3	*Fimbristylys squarrosa*	396.0	1.7	1.2	133.0	1.8	1.9	1.2	1.7	20.0	7.0	70.2	32.4	12.0	24.0	71.5	35.8
4	*Artemisia scentifolia*	45.8	3.9	4.1	18.0	4.6	3.8	4.1	4.2	191.0	88.6	147.0	142.2	16.3	30.2	19.6	22.0
5	*Rumex hastatus*	26.6	12.2	1.4	13.4	4.2	2.0	1.4	2.5	180.4	136.6	95.0	137.3	69.8	39.1	24.6	44.5
6	*Bromus glomerata*	92.6	0.9	0.9	31.5	0.9	1.5	0.9	1.1	6.2	94.0	51.4	50.5	8.0	39.4	40.0	29.1
7	*Setaria viridis*	106.6	17.4	6.9	43.6	8.5	9.6	6.9	8.3	39.0	47.4	89.8	58.7	30.0	47.3	14.3	30.5
8	*Bromus pectinatus*	60.4	0.0	2.4	20.9	2.3	2.0	2.4	2.2	84.2	59.6	59.2	67.7	16.6	18.3	14.3	16.4
9	*Hypericum perforatum*	173.8	0.8	1.5	58.7	1.2	1.9	1.5	1.5	78.2	6.0	80.2	54.8	23.1	16.0	35.8	25.0
10	*Rumex dentatus*	161.4	0.0	9.9	57.1	10.0	5.3	9.9	8.4	87.8	36.6	87.8	70.7	53.7	27.6	17.8	33.0
11	*Cenchrus ciliaris*	71.2	8.7	3.7	27.9	6.1	7.7	3.7	5.8	61.8	82.8	61.0	68.5	19.4	136.4	26.0	60.6
12	*Solanum nigrum*	77.8	4.3	6.3	29.5	6.4	5.9	6.3	6.2	182.8	195.4	190.0	189.4	45.4	46.3	56.5	49.4
13	*Ajuga bracteosa*	60.6	1.3	3.1	21.7	3.7	3.6	3.1	3.5	134.0	136.4	154.4	141.6	43.3	50.5	59.0	50.9
14	*Amaranthus viridis*	71.2	13.5	0.9	28.5	8.6	8.0	0.9	5.8	215.2	224.2	46.8	162.1	78.4	72.2	34.1	61.6
Maximum		396.0	17.4	9.9	141.1	10.0	9.6	9.9	9.9	242.6	274.6	620.4	379.2	78.4	136.4	71.5	95.4
Minimum		2.2	0.0	0.9	1.0	0.9	1.5	0.9	1.1	6.2	6.0	46.8	19.7	8.0	16.0	14.3	12.8
Average		354.2	5.4	3.5	121.0	4.6	4.3	3.5	4.1	123.7	112.9	138.4	125.0	35.3	46.0	37.7	39.7

Key Note: Veg = Vegetative stage, Rep = Reproductive stage, P. Rep = Post reproductive stage

Table. 6.3 Concentration gradient of heavy metals in some medicinal plants at their three phenological stages.

No	Name of the plants	Pb				Cr				Cd			
		Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg
1	*Brachiaria reptens*	34.0	0.0	614.0	216.0	46.0	420.0	88.0	184.7	6.4	0.0	0.0	2.1
2	*Polygonum glabrum*	166.0	12.4	266.0	148.1	82.0	0.0	0.0	27.3	4.2	6.2	35.8	15.4
3	*Fimbristylys squarrosa*	142.0	0.0	786.0	309.3	0.0	12.0	0.0	4.0	0.0	0.0	0.0	0.0
4	*Artemisia scentifolia*	142.0	296.0	0.0	146.0	96.0	112.0	10.0	72.7	15.8	14.8	16.8	15.8
5	*Rumex hastatus*	64.0	0.0	0.0	21.3	0.0	48.0	4.0	17.3	0.0	0.0	0.0	0.0
6	*Bromus glomerata*	238.0	240.0	66.0	181.3	40.0	0.0	0.0	13.3	1.6	1.2	6.0	2.9
7	*Setaria viridis*	120.0	320.0	0.0	146.7	76.0	24.0	22.0	40.7	0.0	1.6	9.4	3.7
8	*Bromus pectinatus*	80.0	212.0	0.0	97.3	0.0	156.0	0.0	52.0	0.0	10.6	10.8	7.1
9	*Hypericum perforatum*	206.0	0.0	0.0	68.7	0.0	8.0	0.0	2.7	12.0	0.0	0.0	4.0
10	*Rumex dentatus*	0.0	480.0	374.0	284.7	80.0	10.0	44.0	44.7	5.0	2.4	5.4	4.3
11	*Cenchrus ciliaris*	148.0	324.0	0.0	157.3	6.0	44.0	0.0	16.7	10.4	16.2	0.0	8.9
12	*Solanum nigrum*	0.0	0.0	0.0	0.0	0.0	50.0	12.0	20.7	4.2	0.0	0.0	1.4
13	*Ajuga bracteosa*	0.0	132.0	0.0	44.0	0.0	56.0	42.0	32.7	3.4	6.6	0.0	3.3
14	*Amaranthus viridis*	0.0	400.0	0.0	133.3	0.0	78.0	0.0	26.0	3.8	2.0	0.0	1.9
Maximum		238.0	480.0	786.0	309.3	96.0	420.0	88.0	184.7	15.8	16.2	35.8	15.8
Minimum		0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	0.0	0.0	0.0	0.0
Average		95.7	172.6	150.4	139.6	30.4	72.7	15.9	39.7	4.8	4.4	6.0	5.1

Key Note: Veg = Vegetative stage, Rep = Reproductive stage, P. Rep = Post reproductive stage

Proximate Composition

The results of proximate analysis and their relevant statistical analysis are shown in Table 1.2 and 1.3 as follows.

Moisture (%)

The moisture contents in the analyzed species varied from 7 – 30 % in vegetative stage, 5.5 – 23.5 % in reproductive stage and 5.3 – 20.6 % in post reproductive stage. The overall average ranged from 6.3 % to 24.7 % among the plants at three phenological stages. The overall percentage of moistures composition was maximum in *Artemisia scentifolia* (30 %) in vegetative stage as well as in reproductive stage (23.5%) and 20.6 % recorded in post reproductive stage. The lowest moisture percentage was recorded in *Cenchrus ciliaris* and *Ajuga bracteosa* (7 % each species) in vegetative stage, 5.5 % in *Bromus glomerata* in reproductive stage and 5.3 % (*Amaranthus viridis*) in post reproductive stage. However, the lowest average was shown by *Bromus glomerata* (6.3 %) and highest average by *Artemisia scentifolia* (24.67 %). It was recorded that post reproductive stage show lowest percentage of moisture in all tested plants.

ANOVA showed that moisture composition among the plant species had no interdependency. The variations between the phenological stages of different species are significant. The standard deviation is lowest in the post reproductive stage, exposed that state not best as forage. The locals store *Bromus glomerata, Setaria viridis, Bromus pectinatus, Cenchrus ciliaris* and *Brachiaria reptens* mostly at their juvenile stage.

The results revealed that moisture contents not only varied among the species but also between the different phenological states of the plants. Hussain *et al.* (2010) also stated that moisture content vary in different species. Das *et al.* (2009) and Hanif *et al.* (2006) concluded that green leafy vegetables had higher moisture content. Our results agreed with them. Saidu & Jideobi (2009) also recordeded highest % of moisture in water leaf. Hussain *et al.*(2009) found high moisture content in *Allium sativum* (67.66 %) and *Valeriana officinalis* (6.82 %). The moisture content in the present case are much less than that of the cited results. Adnan *et al.* (2010) described the ranged of moisture in *Bupleurum falcatum, Forsskalea tenacissima, Lavendula angustifolia, Valeriana officinalis* and *Otostegia limbata* and this agrees with our results.

Nitrogen (%)

Nitrogen content among the tested species varied from 1.2 % to 2.4 % in vegetative stage, 0.7 % to 2 % in reproductive stage and 0.9 % to 2.1 % in post reproductive stage. The maximum contents were recorded in *Polygonum glabrum* (2.41 %) in vegetative stage, *Bromus pectinatus* (2.0%) in reproductive stage and 2.05 % in *Polygonum glabrum* in post reproductive stage. The lowest nitrogen content was present in *Ajuga bracteosa* (1.21%) in vegetative stage, 0.73 % (*Amaranthus viridis*) in reproductive stage and 0.85 % in post reproductive stage. Generally, *Polygonum glabrum* had the highest contents at vegetative stage and post reproductive stage and *Amaranthus viridis* had the lowest content in reproductive and post reproductive stage. The lowest average was recorded for *Ajuga bracteosa* (1.12 %) followed by *Fimbristylys squarrosa* (1.363%). Highest average contents were investigated in *Bromus pectinatus* (2.67 %) while lowest was found in reproductive stage. The vegetative stages had generally higher N content. The results revealed that nitrogen contents were slightly higher in grasses than other plant species (Table 1).

ANOVA showed that the variance among the plants was highly significant between different stages of the phenology were highly significant.

Hussain & Durrani (2008) and Shad *et al.* (2011) investigated total nitrogen (1.36%) in *Nelumbo nucifera*. Their range of % agreed with our results.

Crude Protein (CP)

It refers to all nitrogenous compounds found in plants. It is an important constituent of the food. It is related to the vitamins, calcium, phosphorus and digestibility (Ganskopp & Bohner, 2011; Hussain & Durrani, 2009). The crude protein contents varied from 5.5 to 17.2 % in vegetative stages, 4.3 -16.1% in reproductive stages and 3.3 - 12.4% in post reproductive stages. The lowest content was recorded in *Cenchrus ciliaris* (3.3 %) and highest was presented in *Setaria viridis* (17.2 %). The crude protein contents increased in reproductive stages and decreased in post reproductive stage. It is evident (Table 1) that crude protein content decrease with age. The lowest average was recorded in post reproductive stage (7.6%) followed by reproductive stage (10.4%). Similarly,

lowest average among the phenological stages was noted for *Bromus glomerata* (5.5%) and highest for *Setaria viridis* (14.6 ppm).

Statistical analysis indicated that standard deviation had the lowest value for post reproductive stage (2.7), which showed that values are closely related as compared to reproductive stages (3.5). ANOVA also represented the variance among species and between different phenological stages highly significant for crude protein. It is obvious that vegetative stage had the highest concentration of CP than other stages. This is in accordance with the findings of Hussain & Durrani (2008); Ganskopp & Bohner (2001) and Khan *et al.* (2004) who also stated that CP values average values higher at vegetative stages than other stages. It is stated that cattle, sheep and goats grazed during spring and to the end of summer due to the abundance of proteins that maintain growth and development of animals. Hanif *et al.* (2006) estimated protein (0.9 % to 2.1 %) in the selected vegetables. The plants growing at higher altitudes experiences quite different climate and had higher content of CP than plants of plains. Cheema *et al.*(2011) reported high concentration of CP in leaves of *Morus alba* and is a best source of protein in ruminant feeding. They also described that different level of CP is due to differences of protein accumulation. Our results suggested that the investigated plants had sufficient level of protein which is the best source of supplement both in summer and winter. Yao *et al.* (2000) said that *morus alba* is a best source of protein for ruminants. Adenipekun Oyetunji (2010) observed little differences between *Vigna unguiculata* (23%) and *Arachis hypogeal* (24%). Hussain *et al.* (2010) also found that *Sonchus asper* and *Melia azadrichta* had the highest concentration of proteins. Our result agrees with above mentioned works. Plants like *Polygonum glabrum, Fimbristylys squarrosa, Hypericum perforatum, Rumex dentatus, Solanum nigrum, Ajuga bracteosa* and *Amaranthus viridis* had also the highest content of CP than other species. Hussain *et al.*(2009) reported 6.4 % in ginger, James & Friday (2010) said that protein content vary from parts to parts in plants. According to Shah *et al.* (2009) who stated that protein rich plants had 23% - 33%, our all investigated plants had moderate level of proteins. The results are also in line with Hameed *et al.* (2008), Adnan *et al.* (2010) and Hussain *et al.* (2010).

Crude Fibers (CF)

Fiber is an important constituent of balance diet that decreases blood cholesterol level, heart risks, colon cancer and diabetes (Ishida *et al.*, 2000). The RDA values of fibers for children are 19-25% and for lactating mother is 29 %.

In the present study, generally it various ranges from 10.3% - 22.7 % at phenological stages. The results revealed that fibers content increase and naturally it happened so. The minimum fiber content was recorded for *Ajuga bracteosa* (10.3 %) and maximum % of fiber content in *Bromus glomerata* (20.5%) at vegetative stages. It varied from minimum 12.4 % (*Ajuga bracteosa)* to maximum 21.5 % (*Bromus glomerata*) in reproductive stages. In post reproductive stages. It fluctuated from 14.9% (*Cenchrus ciliaris*) to 22.7% (*Bromus glomerata*) in post reproductive stage. The lowest average was recorded in vegetative stages (14.6 %) and highest average in post reproductive stage (18.2 5). Similarly, lowest average % content shared by *Ajuga bracteosa* (12.7 %) and highest average % contributed by *Bromus glomerata* (21.6 %).

The statistical analysis (ANOVA) showed that variance among the species and between different phenological stages is highly significant. The post reproductive stages showed minimum standard deviation from their mean values, indicated dependency of the values. Belewu & Babalola (2009) stated that crude fibers can be used for useful purposes if treated with microorganisms. Hussain *et al.* (2010) estimated fibers varied from 9.5 % to 12.12% in selected medicinal plants. This range is similar to our range of values. Hameed *et al.* (2008) determined CF in ranged of 5.32% (*Polygonum plebjum*) to 19.37 %(*Rumex hastatus*). In our study, *Rumex hastatus* had about the same values. *Polygonum glabrum* (15.7%) also had similar % values. Table 1.5 present crude fiber content of selected plants, *Rumex dentatus, Solanum nigrum, Ajuga bracteosa* and *Amaranthus viridis* are the main food eaten by man and animal. These plants are also medicinally important and useful in colon and urinary cancer. Hussain *et al.*(2010) stated that higher level of fibers increases digestibility but high content in diet can cause intestinal irritation. It can be deduced from the results that plants like *Rumex dentatus* and *Solanum nigrum* are very effective in digestion and some abdominal ailment.

Ether Extract (EE)

Table 1.2 depicts that the differences were highly significant between the tested species and non significant among the phenological stages. It varied from 4.3 % (*Fimbristylys squarrosa*) to 8.2 % (*Polygonum glabrum*) in vegetative stages, 4.2 % (*Setaria viridis*) to 9.4% (*Polygonum glabrum*) in reproductive stage and 4.1% (*Fimbristylys squarrosa*) to 10.3% (*Polygonum glabrum*) in post reproductive stage. The vegetative and reproductive stages had similar average % (5.9%) while post reproductive stage had higher % (6.4 %) than other two stages. Hussain & Durrani (2008) described that the difference between vegetative and post reproductive stages were significant which did not agree with our results. Minimum average was recorded for *Fimbristylys squarrosa* (4.2 %) and maximum was recorded for *Polygonum glabrum* (9.3%).

Ash

The ash content in vegetative stage varied from 9 % - 89 %, 6 % - 61 % in reproductive stage and 5 % to 31 % in post reproductive stage. The data revealed that a trend of decreasing order is found with aging of plant. The minimum ash % was recorded in post reproductive stage (5%) and maximum was recorded in vegetative stage (89%). The average % of ash ranged from 12.3 % (*Artemisia scentifolia*) to 49.7 % (*Hypericum perforatum*). The ANOVA depicted that variance among the plant species and between different phenological behaviors are non significant. Deviation from mean is high in vegetative stage than other stages. Hussain *et al.*(2010) determined ash % in *Melia azadarichta, Sonchus eruca, Withania cogulans* and *Fagonia indica* which ranged 10.6% to 16%. Hameed *et al.*(2008) recorded 15% ash content in root of *Persicaria maculosa.* Hussain *et al.*(2009) reported 19 % ash content in garlicare tablets. Ash content of the herbs is smaller than the forbs. The results revealed that ash content of forages decrease progressively with age of plants. Similar to our findings, Klicher (1981) also suggest similar trends. However, Azim *et al.* (1989); Wahid (1990) and Hussain & Durrani (2008) observed high content of ash with age of plants.

Carbohydrates

The data revealed that there was an ascending pattern of carbohydrates in all tested species. It is evident from Table 1.5 that grasses had higher contents of carbohydrates. It varied from 38.5 % (*Polygonum glabrum)* to 84.6 % (*Rumex hastatus*)

in vegetative stages, 40.2 % (*Setaria viridis*) to 80.1 % (*Bromus glomerata*) in reproductive stages and 50.3 % (*Amaranthus viridis*) to 82.2 % (*Bromus glomerata*) in post reproductive stages. Similarly, the lowest average was recorded in vegetative stages (61.1 %) and highest average was recorded for (68.9 %) post reproductive stage. The lowest average was investigated for *Amaranthus viridis* (48.03 %) and highest average was recorded for *Rumex dentatus* (78.4 %) at three phenological stages. The differences among tested species were highly significant ($p = 0.05$) but were non significant between phenological stages. Holechek *et al.* (1998) and Hussain & Durrani (2008) stated that high level of carbohydrates in forages is important for animals because carbohydrates are ready made source of energy. Hussain *et al.*(2010) investigated that carbohydrates ranged between 18.3 to 64.3 %, which agree with our results. The present finding also agree with Hussain *et al.* (2010 a, b,c), Adenipekun & Oyetunji (2010), Hanif *et al.*(2006), James & Friday (2010) and Adnan *et al.*(2010). In this respect, however Hameed *et al.* (2008) reported otherwise.

Hemicellulose

The results revealed that grasses had higher hemicellulose contents than forbs. It varied from 10.2 % (*Brachiaria reptens*) to 23.5 % (*Fimbristylys squarrosa*) in vegetative stages, 10.2 % (*Bromus pectinatus*) to 25.2 % (*Fimbristylys squarrosa*) in reproductive stages and 10.4 % (*Solanum nigrum*) to 31.5 % (*Fimbristylys squarrosa*) in post reproductive stages. As a whole hemicellulose contents ranged from 10.2 % to 31.5 % among the tested plants. The lowest average was recorded at reproductive stages (17.2 %) and highest average recorded in post reproductive stages (20.5 %). The individual minimum average accounted for *Amaranthus viridis* (12.7 %) and highest average *Fimbristylys squarrosa* (26.7 %). The differences were highly significant among different plants and were significant between phenological stages. Hussain & Durrani (2008) described that structural carbohydrate composition varies with seasons and growth stages. Holechek *et al.* (1998) stated that livestock preferred grasses because they can use efficiently cellulose and hemicellulose due to the presence of microorganisms in their gut.

Neutral detergent fiber (NDF)

NDF contents were low in vegetative stages of the tested species and were high in post reproductive stages. It varied from 30.4 % (*Polygonum glabrum*) to 78.6 % (*Fimbristylys squarrosa*). NDF range from 30.4 % (*Polygonum glabrum*) to 68.5% (*Fimbristylys squarrosa*) in vegetative stage, 40.3% (*Rumex dentatus*) to 76.6 % (*Hypericum perforatum*) in reproductive stage and 40.5 % (*Solanum nigrum*) to 78.6 % (*Fimbristylys squarrosa*) in post reproductive stage. Vegetative stage (44.5 %) had minimum average NDF concentration while post reproductive stage (63.3 %). Similarly, *Solanum nigrum* (39.8 %) had the lowest average and *Fimbristylys squarrosa* (78.6 %) had the highest average at all stages.

The results revealed that grasses had usually high concentration of NDF than other estimated plants. The variations were highly significant among tested plants and phenological stages. The findings of Ganskopp & Bohner (2001); Sultan *et al.* (2007) and Hussain & Durrani (2008) agree to our results that NDF increases with age of plants. Dabo *et al.*, (1980), Wahid, (1990), Hussain & Durrani (2009) also stated that NDF is related to the phenological behavior of plants and strongly affected by maturity. This agrees with the present work. Cheema *et al.* (2011) determined highest NDF in *Ziziphus jujuba* and lowest in *Acacia nilotica.* This range does not agree with above sited review.

Acid detergent lignin (ADL)

The present study revealed that ADL like other parameters increased with maturity in the tested species. It varied from 3.6 % (*Rumex hastatus*) to 13.7 % (*Ajuga bracteosa*) in vegetative stage, 3.5 % (*Rumex dentatus*) to 15.9 % (*Setaria viridis*) in reproductive stage and 2.2 % (*Solanum nigrum*) to 21.2 % (*Setaria viridis*) in post reproductive stages. The lowest average accounted for vegetative stages and highest average recorded for post reproductive stages. The individual minimum average value was shown by *Cenchrus ciliaris* and highest by *Setaria viridis.* The data revealed that grasses accumulate more ADL with maturity. The statistical analysis showed that the differences among different species and phenological stages were non significant. Hussain & Durrani (2008) and Kramberger & Klemencic (2003) described that lignin content was higher in stem than leaves and also its concentration enhances as the plants grow. Our results support this statement. Similarly, the present findings agreed with the

work of Robles & Boza (1993); Azim *et al.* (1998); Wahid (1990) and Sultan *et al.* (2007) who observed increasing ADL contents with increase of age of plants.

Acid detergent fibers (ADF)

ADF contents varied from 10.5 % (*Cenchrus ciliaris*) to 51.2 % (*Bromus glomerata*) in post reproductive stage. The lowest average of ADF contents was recorded in vegetative stage while highest average was determined for reproductive stages (Table 2). The variations among species and different phenological stages were non significant. It showed an ascending trend in concentration with age of plants (Table 3). Hussain & Durrani (2008) stated that ADF had almost similar trend like NDF. Our findings were supported by Cheema *et al.* (2011), Sultan *et al.* (2007) and Wahid, (1990) and Ashraf (1995) also reported high level of ADF in fodder species at different stages.

Nitrogen free Extract (NFE)

The statistical analysis revealed that differences among different tested species were significant and showed little deviation from the mean values, while phenological stages represented that variation was highly significant. *Bromus glomerata* (50.8 %) had the highest in vegetative stage, *Ajuga bracteosa* (63.6 %) in reproductive stage and *Setaria viridis* (58.6 %) had the highest value at post reproductive stage. The lowest average was recorded in vegetative stage and highest average of NFE estimated in post reproductive stage. Generally, *Hypericum perforatum* (37.4 %) had the lowest average value in all plants and *Setaria viridis* (53.5 %) had maximum average. The NFE values ranged similar in the results as reported by Hussain & Durrani, (2008).

Table 1. Proximate composition of selected forage plants of Chakesar Valley, District Shangla, Pakistan.

		Moisture (%)				N (%)				Crude Protein (%)				Crude Fibers (%)				Ether Extract (%)				Ash (%)			
No	Species	Veg	Rep	P..Rep	Avg	Veg	Rep	P..Rep	Avg	Veg	Rep	P..Rep	Avg	V	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P..Rep	Avg
1	*Brachiaria reptens*	17	14.3	14.5	15.3	1.93	1.62	1.72	1.76	10.5	7.2	9.6	9.1	13.1	15.2	15.7	14.7	7.2	7.5	8.5	7.73	20	29	19	22.7
2	*Polygonum glabrum*	18	13.5	10.1	13.9	2.41	1.53	2.05	2	14.7	13.3	10.5	12.9	15.3	14.2	17.6	15.7	8.2	9.4	10.3	9.3	74	8	31	37.7
3	*Fimbristylys squarrosa*	20	21.5	20.6	20.7	1.59	1.07	1.43	1.36	12.9	14.3	8.7	12.0	13.4	12.5	18.5	14.8	4.3	4.2	4.1	4.2	88	28	18	44.7
4	*Artemisia scentifolia*	30	23.5	20.5	24.7	1.78	1.35	1.3	1.48	10.7	9.5	7.4	9.2	12.4	13.6	17.5	14.5	5.4	5.1	5.3	5.27	9	8	20	12.3
5	*Rumex hastatus*	16	15.6	11.5	14.4	1.93	1.63	1.67	1.74	5.5	8.4	5.5	6.5	13.7	12.5	18.6	14.9	6.3	6.2	7.1	6.53	45	13	20	26
6	*Bromus glomerata*	8	5.5	5.5	6.33	1.49	1.4	1.35	1.41	8.1	4.3	4.1	5.5	20.5	21.5	22.7	21.6	7.2	6.7	7.3	7.07	45	7	10	20.7
7	*Setaria viridis*	14	15.3	15.2	14.8	1.81	1.62	1.71	1.71	17.2	16.1	10.5	14.6	18.4	19.5	21.7	19.9	4.4	4.2	4.6	4.4	89	17	10	38.7
8	*Bromus pectinatus*	17	15.6	15.3	16	2.32	2.01	1.87	2.07	12.5	8.1	4.2	8.3	17.7	18.5	19.6	18.6	5.2	5	5.3	5.17	81	6	20	35.7
9	*Hypericum perforatum*	15	16.5	15.3	15.6	1.63	1.51	1.54	1.56	14.6	10.5	7.5	10.9	14.3	15.6	18.5	16.1	6.3	6.1	6.6	6.33	70	61	18	49.7
10	*Rumex dentatus*	9	9.2	10.3	9.5	2.11	1.91	1.94	1.99	12.5	10.7	6.9	10.0	11.5	16.4	17.5	15.1	4.5	4.2	4.6	4.43	43	7	5	18.3
11	*Cenchrus ciliaris*	7	6.5	6.4	6.63	2.15	1.87	1.97	2	8.5	5.1	3.3	5.6	12.4	14.8	14.9	14	5.4	5.1	5.7	5.4	55	20	20	31.7
12	*Solanum nigrum*	10	8.6	7.5	8.7	1.53	1.5	1.47	1.5	13.1	10.8	7.4	10.5	17.5	17.7	18.8	18	6.2	6.1	6.8	6.37	88	19	19	42
13	*Ajuga bracteosa*	7	6.6	5.6	6.4	1.21	1.1	1.05	1.12	15.1	14.1	12.4	13.9	10.3	12.4	15.4	12.7	7.3	7.5	7.6	7.47	56	21	20	32.3
14	*Amaranthus viridis*	8	8.3	5.3	7.2	1.32	0.73	0.85	0.97	16.3	12.6	8.4	12.4	14.2	16.5	18.2	16.3	5.2	4.7	5.3	5.07	20	14	13	15.7
Maximum		30.0	23.5	20.6	24.7	2.4	2.0	2.1	2.1	17.2	16.1	12.4	14.6	20.5	21.5	22.7	21.6	8.2	9.4	10.3	9.3	89.0	61.0	31.0	49.7
Minimum		7.0	5.5	5.3	6.3	1.2	0.7	0.9	1.0	5.5	4.3	3.3	5.5	10.3	12.4	14.9	12.7	4.3	4.2	4.1	4.2	9.0	6.0	5.0	12.3
Average		14.0	12.9	11.7	12.9	1.8	1.5	1.6	1.6	12.3	10.4	7.6	10.1	14.6	15.8	18.2	16.2	5.9	5.9	6.4	6.1	55.9	18.4	17.4	30.6
S.D		6.5	5.6	5.3	5.6	0.4	0.3	0.4	0.3	3.3	3.5	2.7	2.9	2.9	2.8	2.2	2.5	1.2	1.5	1.7	1.5	27.0	14.4	6.2	11.5

Table 2. Proximate composition of the selected forage plant species of Chakesar Valley, District Shangla, Pakistan.

		NDF (%)				ADF (%)				Hemicellulose (%)				ADL (%)				NFE (%)				Carbohydrates (%)			
No	Species	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg	Veg	Rep	P.Rep	Avg
1	*Brachiaria reptens*	35.1	65.2	70.3	56.9	17.3	24.4	45.3	29	10.2	14.4	17.8	14.1	5.2	8.8	8.4	7.47	38.3	37.5	45.6	40.5	54.3	64.3	59.7	59.4
2	*Polygonum glabrum*	30.4	62.5	68.5	53.8	24.2	37.5	40.2	34	17.3	20.3	27.5	21.7	10.1	7.5	10.4	9.33	45.5	45.6	55.3	48.8	38.5	55.4	60.3	51.4
3	*Fimbristylys squarrosa*	68.5	75.7	78.6	74.3	30.5	28.4	32	30.3	23.5	25.2	31.5	26.7	4.3	14.6	12.2	10.4	30.6	37.4	48.6	38.9	47.1	63.6	75.5	62.1
4	*Artemisia scentifolia*	37.5	65.6	70.8	58	31.3	25.4	47.6	34.8	15.7	13.5	12.4	13.9	8.5	13.7	11.3	11.2	45.3	46	55.7	49	62.5	75.5	80.1	72.7
5	*Rumex hastatus*	41.5	60.5	68.6	56.9	28.1	40.7	41.3	36.7	16.6	18.7	18.3	17.9	3.6	12.5	15.2	10.4	44.5	47.4	57.7	49.9	84.6	73.3	75.5	77.8
6	*Bromus glomerata*	51.3	70.4	70.4	64	31.2	42.5	51.2	41.6	17.5	17.4	27.2	20.7	9.5	10.7	18.7	13	50.8	48.3	55.6	51.6	72.7	80.1	82.2	78.3
7	*Setaria viridis*	52.3	70.8	71.7	64.9	35.5	40.7	37.5	37.9	22.7	24.5	23.3	23.5	7.7	15.9	21.2	14.9	47.5	54.5	58.6	53.5	55.3	40.2	58.3	51.3
8	*Bromus pectinatus*	55.6	75.7	76.5	69.3	28.3	37.5	48.5	38.1	21.4	10.2	13.2	14.9	4.8	10.6	12.6	9.33	35.3	44.3	58.3	46	60.4	73.5	76.7	70.2
9	*Hypericum perforatum*	40.5	76.6	70.6	62.6	30.6	36.8	17.1	28.2	17.5	16.6	18.3	17.5	5.6	15.6	16.7	12.6	40.2	36.4	35.6	37.4	45.5	51.4	73.4	56.8
10	*Rumex dentatus*	33.5	40.3	45.6	39.8	26.7	34.2	14.3	25.1	20.7	14.7	18.3	17.9	11.7	3.5	10.8	8.67	42.1	45.6	39.3	42.3	81.3	76.3	77.5	78.4
11	*Cenchrus ciliaris*	61.3	70.5	65.3	65.7	29.5	35.1	10.5	25	22.2	21.3	25.2	22.9	12.5	4.3	3.3	6.7	36.3	55.6	38.5	43.5	72.4	46.2	56.2	58.3
12	*Solanum nigrum*	37.3	41.5	40.5	39.8	21.4	40.3	13.2	25	16.5	14.2	10.4	13.7	10.6	7.5	2.2	6.77	48.2	60.3	50.6	53	73.3	75	74.1	74.1
13	*Ajuga bracteosa*	37.5	40.3	45.4	41.1	28.3	25.2	12.7	22.1	15.6	20.1	27.7	21.1	13.7	6.6	5.6	8.63	44.6	63.6	52.5	53.6	65.4	70.5	65.2	67
14	*Amaranthus viridis*	41.3	42.3	43.5	42.4	27.7	42.2	41.3	37.1	12.3	10.3	15.5	12.7	13.6	10.5	7.6	10.6	42.5	55.3	46.7	48.2	42.5	51.3	50.3	48
Maximum		68.5	76.6	78.6	74.3	35.5	42.5	51.2	41.6	23.5	25.2	31.5	26.7	13.7	15.9	21.2	14.9	50.8	63.6	58.6	53.6	84.6	80.1	82.2	78.4
Minimum		30.4	40.3	40.5	39.8	17.3	24.4	10.5	22.1	10.2	10.2	10.4	12.7	3.6	3.5	2.2	6.7	30.6	36.4	35.6	37.4	38.5	40.2	50.3	48
Average		44.5	61.3	63.3	56.4	27.9	35.1	32.3	31.8	17.8	17.2	20.5	18.5	8.67	10.2	11.2	10	42.3	48.4	49.9	46.9	61.1	64	68.9	64.7
Standard Deviation		11.4	14.1	13.3	11.6	4.53	6.57	15.3	6.17	3.9	4.71	6.59	4.35	3.53	4	5.56	2.39	5.59	8.47	7.78	5.52	14.6	12.9	10.2	10.8

Key Note: NDF = Neutral Detergent Fibers, ADF = Acid detergent fibers, ADL = Acid detergent lignin, NFE % = Nitrogen free extract.

Table 3. ANOVA for proximate analysis of species and their phenological stages of some selected forage plants of Chakesar valley, Distrct Shangla, Pakistan.

Source of Variation	df	Moisture (%)	N (%)	Crude Protein (%)	Crude Fiber (%)	Ether extract (%)	Ash (%)	NDF (%)	ADF (%)	ADL (%)	NFE (%)	Hemicellulose (%)	Carbohydrates (%)
Between the Plant Species	13	95.7**	0.3**	25.5**	18.1**	8.1**	398.3 ns	400.22**	114.154 ns	17.163 ns	91.36*	56.75**	347.78**
Between the Phenological Stages	2	18.7**	0.3**	78.2**	47.4**	1.6ns	6755.3 ns	1484.7**	183.044 ns	21.917 ns	229.5**	41.35*	217.47 ns
Error	26	3.0	0.017	2.5	1.4	0.666	289.8	51.875	92.233	21.117	36.049	12.029	68.106

Conservation Status of some Medicinal Plants

Biodiversity is abbreviated form of biological diversity and refers to living things on the earth. Plants are an important resource and have immense impact on ecosystem and have a vital role in socioeconomic conditions of the people.

Shangla is located in Hindu Kush Himalayan mountainous ranges and is a unique site and had diversed flora. Non scientific and indiscriminate collection of medicinal plants in various parts of the country has led to the severe pressure on the availability of medicinal plants. It is difficult to know that how much medicinally important plants are threatened. According to IUCN, (2001) threatened plant data base, about 32000 species of plants are threatened with extinction. This figure represent 13 % of estimated 250, 000 of plants.

According to Hamayun *et al.* (2005), there are 92 threatened plant species in District Swat of which 28 species are endangered, 40 vulnerable and 24 are rare. Chakesar valley located in Sino Japanes region and reaches to the basin of Saharo Sindian region. The valley is unexplored in all aspect of plants and no work has been done regarding plant conservation and restoration. It is inhabited and composed of a number of settlements. It is one of the exploited Valleys of district Shangla. People depend on plants for their own requirements. Forests are also a resource of their livelihood. They ruthlessly cut off the forests and also smuggle to the surrounding area and use it a source of their revenue. They are illiterate and do not know the repercussion of such indiscriminate cutting i.e. why, floristic composition representing 127 most important medicinal plants of the area, in which 47 (37%) endangered species, 32 (25 %) vulnerable, 36 (28 %) rare and 12 (9%) species are infrequent (Table. Fig.). Some of the important endangered species included *Abies pindrow, Acer oblongum, Aesculus indica, Alnus nitida, Berberis kunawarensis, Celtis australis, Desmodium elegans,Hedra helix, Hedra nepalensis, Juglan regia, Olea ferruginea, Paeonia emodi, Picea smithiana, Pinus gerardiana, Pisticia integrima, Quercus semicarfifolia, Vibernum grandiflorum* and *Woodfordia fruticosa*. Ghazanfar & Osborne (2010) studied the conservation through restoration and investigated that site consists of mainly a few trees and shrubs that have tolerated grazing pressure and those that are unpalatable to camel and goats. No regeneration is visible around the trees and shrubs and significant fruiting

has been recorded. These observations were similar to the research sites, no sapling was recorded and regeneration seems to be completely vanished. Only Dhali Hill has sampling but this site is under extreme biotic interference. This show immense pressure and disturbance in vegetation. The conservation status show that mostly trees are under severe pressure.

Vulnerable species of the valley included *Abutilon indicum, Aconitum violate, Bergenia ciliate, Gerardiana palmate, Indigofera hetrantha, Morchella esculenta, Podophylum emodi, Rubus fruticosus, Rubus sanctus, Salvia lanata, Salvia nubicola, Stachys seriaca, Thymus serphylum, Valeriana jacomontii* and *Viola serpens.* Hamayun *et al.*(2006) assessed conservation status of plants and revealed that increased exploitation and unsustainable harvesting, 49 % of medicinal plants are threatened. Similarly, Shaheen *et al.* (2011) and Ahmad *et al.*(2006) stated that over the past few decades, the Himalayan forests have experienced unprecedented land use changes driven by rapid human population growth and intensifying anthropogenic activities, such as agriculture and expanding human settlements. It is known that people traditionally used fuel wood of the forests and this is the main cause of forests degradation. The intensive grazing and land leveling for agriculture also present the pathetic scene of the valley. Dependency on forests for fuelwood is causing severe deforestation in the Himalayas. Hamayun *et al.*(2006) revealed that 17.61 % plants of Gabral and Utror valley are threatened, 4.5 % are endangered, 5.68 % vulnerable, 4.5 % rare and 2.8% near threatened.

The species become rare and included *Acorus calamus, Arisaema flavum,Artemisia scoparia, Artemisia vulgare, Clematis grata, Euphorbia wallichii, Geranium wallichianum,Gerbera gossypina, Hypericum perforatum, Inula grantioides, Sauromatum venosum, Saussoria albescens, Thalictrum pendunculatum* and *Urtica dioica.* Bocuk *et al.* (2009) identified 77 taxa are endemic to Turkey in which 56 taxa are in least concern, 9 in near threatened, 4 in vulnerable risk categories. Grazing and land use are generally considered to be the most economical way of utilizing range land vegetation. Abbas *et al.*(2010) determined conservation status of *Cadaba heterotricha* according to IUCN 2001, Red datalist categories and criteria. They classified it as

endangered species. Haq (2011) studied conservation status of critically endangered species in the Nandiar Khuwarr catchment area, Battagram.

The infrequent species comprised of *Artemisia japonica, Astragalus chlorostachys*, *Astragalus pyrrotrichus, Imaptiens balsiminea* and *Impatiens parviflora.*

Haq (2011) reported 37 taxa including 14 critically endangered and 23 endangered species. Loss of habitat, unplanned collection, deforestation, overgrazing and erosion, attack of pathogens and effects of introduced taxa were the major threats to the vegetation. It is stated that rate of plant extinction has reached to one species per day as a result of anthropogenic activities and this is considered 1000 – 10,000 time faster than would occur naturally(Hilton-Taylor, 2000; Akeroyd, 2002). If the trend remains constant, 60,000 and 100,000 plant species may disappear in the near future (Akeroyd, 2002; Bramwell, 2002). Ali & Qaiser (2010) reported that *Gaillonia chitralensis* Nazim is endemic to Chitral district and is classified and endangered species according to IUCN Red List categories and crieteria 2001.

Fig. Comparative pecentage of conservation status of total plants and medicinally important plants.

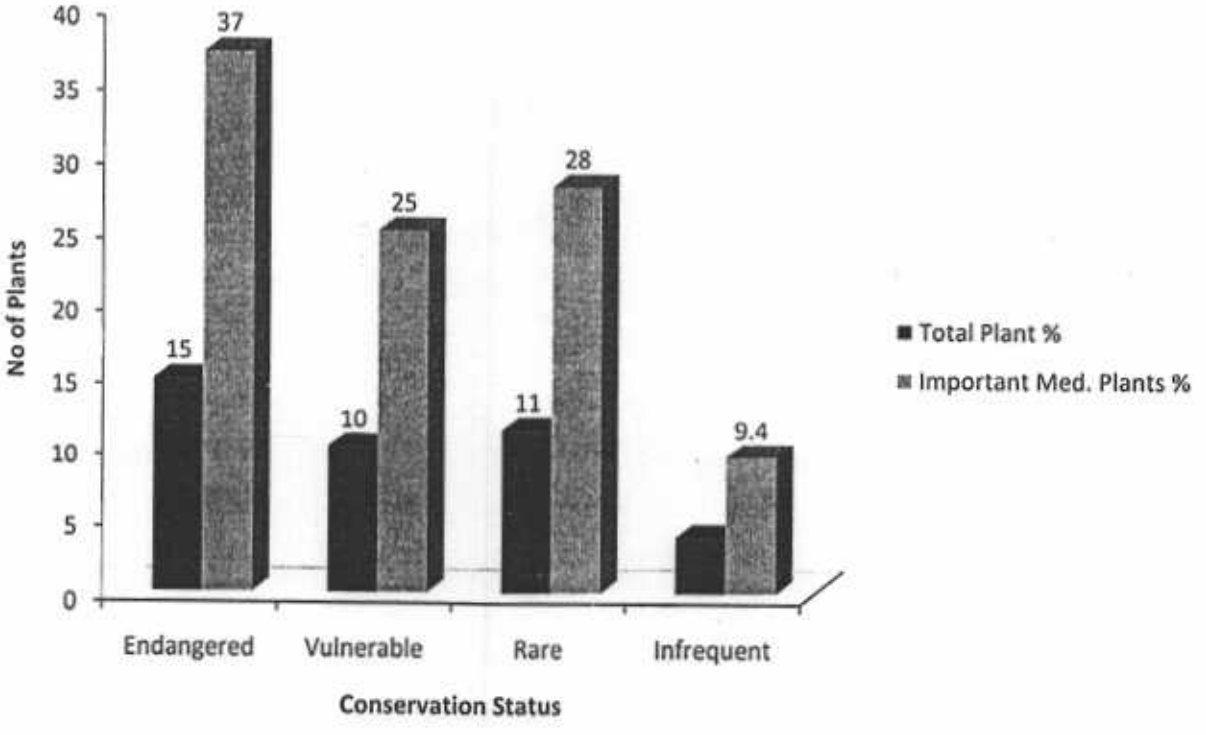


Fig. Conservation status of medicinal plants of Chakesar, District Shangla.

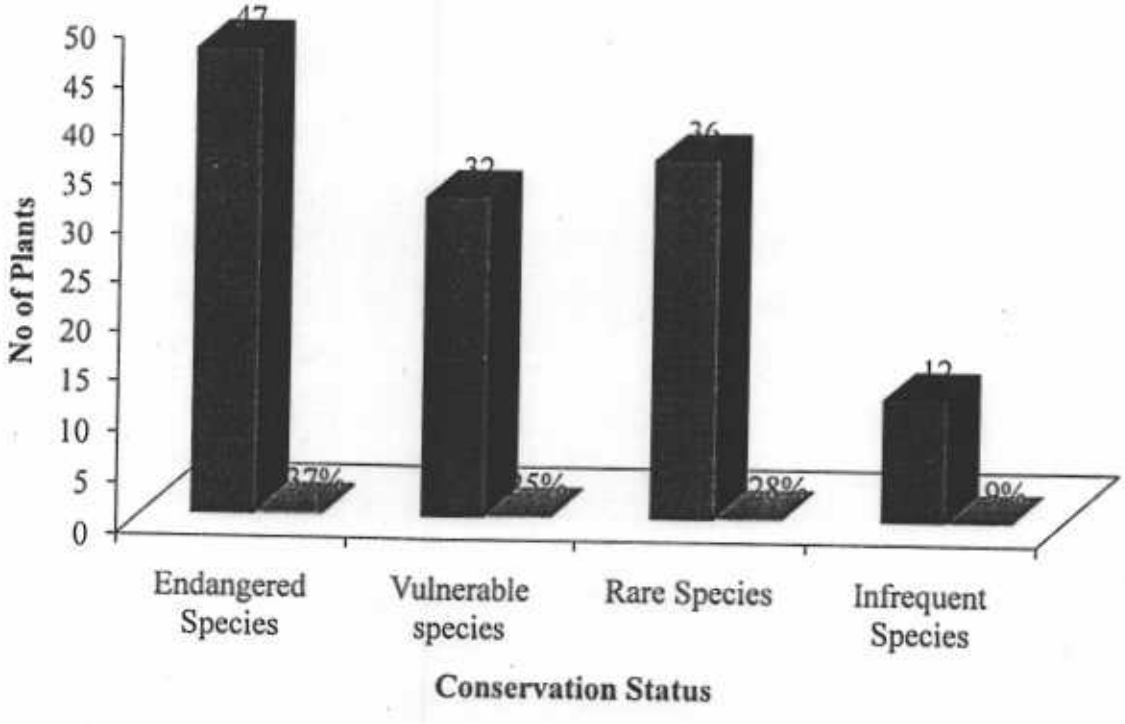


Table. Status of commercially important indeginous medicinal plants of Chakesar, District Shangla, Pakistan.

		Availability				Collection				Growth					Part Used					Total	Status
No	Species	0	1	2	3	0	1	2	3	0	1	2	3	4	0	1	2	3	4	Score	
1	*Abies pindrow* Royle	0	-	-	-	0	-	-	-	0	-	-	-	-	-	1	-	-	-	1	Endangered
2	*Abutilon indicum* Sweet.	-	1	-	-	-	1	-	-	-	1	-	-	-	-	-	-	3	-	6	Vulnerable
3	*Acacia modesta* Wall.	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
4	*Acasia nilotica* (L.) Delile	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
5	*Acer oblongum* Wallich ex DC.	-	-	2	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	2	Endangered
6	*Aconitum violate* Jacque. Staff.	-	1	-	-	-	-	-	3	-	-	-	3	-	0	-	-	-	-	7	Vulnerable
7	*Acorus calamus* Linn.	-	1	-	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	12	Rare
8	*Aesculus indica* (Colebr. Ex Cambess.) Hook.	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
9	*Ailanthus altissima* (Miller) Swingle	-	-	-	3	0	-	-	-	-	-	-	3	-	0	-	-	-	-	6	Vulnerable
10	*Ajuga bracteosa* Wallich ex Benth.	-	-	2	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	13	Infrequent
11	*Ajuga parviflora* Benth.	-	-	2	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	13	Infrequent
12	*Alnus nitida* (Spach) Endl.	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
13	*Alcea rosea* (Linn.) Cav.	-	1	-	-	-	-	-	3	-	-	-	3	-	0	-	-	-	-	7	Vulnerable
14	*Andrachne cordifolia* (Dcne.) Mull. Arg.	-	-	2	-	-	1	-	-	-	-	-	3	-	0	-	-	-	-	6	Vulnerable
15	*Arisaema flavum* (Forssk.) Schott.	-	-	2	-	-	-	-	3	-	-	-	-	4	0	-	-	-	-	9	Rare
16	*Arisaema jacquemonti* Blume	-	-	2	-	-	-	-	3	-	-	-	-	4	0	-	-	-	-	9	Rare
17	*Arisaema utile* Hook. F. ex Schott.	-	-	2	-	-	-	-	3	-	-	-	-	4	0	-	-	-	-	9	Rare
18	*Artemisia dubia* Wall.	-	-	2	-	-	-	-	3	-	-	-	-	4	0	-	-	-	-	9	Rare
19	*Artemisia japonica* Thunb., Fl. Jap.	-	-	2	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	13	Infrequent
20	*Artemisia santilifolia*	-	-	2	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	13	Infrequent
21	*Artemisia scentonema*	-	-	2	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	13	Infrequent

22	*Artemisia scoparia* Waldst. & Kit.	-	1	-	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	12	Rare
23	*Artemisia vulgare*L.	-	1	-	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	12	Rare
24	*Asparagus officinalis*	-	1	-	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	12	Rare
25	*Astragalus chlorostachys* Lindl.	-	-	2	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	13	Infrequent
26	*Astragalus pyrrotrichus*	-	-	2	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	13	Infrequent
27	*Berberis kunawarensis* Royle.	-	-	2	-	0	-	-	-	-	-	2	-	-	0	-	-	-	-	4	Endangered
28	*Berberis lycium* Royle.	-	-	2	-	0	-	-	-	-	-	2	-	-	0	-	-	-	-	4	Endangered
29	*Bergenia ciliata* (Haw) Sternb	-	1	-	-	-	-	2	-	-	-	-	3	-	0	-	-	-	-	6	Vulnerable
30	*Celtis australis* Wild.	0	-	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	0	Endangered
31	*Cichorum intybus* L.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	-	-	3	-	10	Rare
32	*Cirsium wallichi* DC.	-	-	2	-	-	-	-	3	-	-	-	3	-	-	-	-	3	-	11	Rare
33	*Clematis grata* Wall.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	-	2	-	-	9	Rare
34	*Commelina bengalensis* L.	-	-	2	-	-	1	-	-	-	-	-	-	4	-	-	-	-	4	11	Rare
35	*Cotoneaster nummularia* Fish & Mey	-	1	-	-	-	1	-	-	-	-	2	-	-	0	-	-	-	-	4	Endangered
36	*Cotoneaster nummularia* Fish &Mey	-	1	-	-	-	1	-	-	-	-	2	-	-	0	-	-	-	-	4	Endangered
37	*Cousinia thomsoniiC. B. Clarke*	-	1	-	-	-	1	-	-	-	-	-	3	-	-	-	-	3	-	8	Vulnerable
38	*Crataegus oxycantha* L.	0	-	-	-	0	-	-	-	-	-	-	3	-	0	-	-	-	-	3	Endangered
39	*Crotolaria juncea* L.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	-	-	-	4	11	Rare
40	*Dalbergia sisso* Roxb.	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
41	*Daphne oloides* Schreb.	-	1	-	-	-	1	-	-	-	-	2	-	-	0	-	-	-	-	4	Endangered
42	*Debregetia salisifolia* (D. Don) Renle.	-	1	-	-	0	-	-	-	-	-	2	-	-	0	-	-	-	-	3	Endangered
43	*Delphinium ajacis* Linn.	0	-	-	-	-	-	-	3	-	-	-	-	4	-	-	-	3	-	10	Rare
44	*Delphinium denudatum* Wallich ex Hook. F.	0	-	-	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	11	Rare
45	*Desmodium elegans* DC.	-	1	-	-	-	1	-	-	-	-	2	-	-	0	-	-	-	-	4	Endangered
46	*Diospyrus kaki* Linn.	-	1	-	-	-	-	-	3	0	-	-	-	-	-	-	-	3	-	7	Vulnerable

47	*Euphorbia wallichii* Hook. f.	0	-	-	-	-	-	-	3	-	-	-	3	-	-	-	-	-	4	10	Rare
48	*Ficus carica* Linn.	-	1	-	-	-	-	-	3	0	-	-	-	-	-	-	-	3	-	7	Vulnera[redacted]le
49	*Ficus elastica* Roxb.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	-	-	3	-	10	Rare
50	*Ficus palmata* Forssk.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	-	-	3	-	10	Rare
51	*Ficus racemosa* Linn.	-	1	-	-	-	-	2	-	-	-	-	3	-	-	-	-	3	-	9	Rare
52	*Geranium rotundifolium* Linn.	-	-	2	-	-	-	2	-	-	-	-	-	4	-	-	2	-	-	10	Rare
53	*Geranium wallichianum* D. Don.	-	-	2	-	-	-	2	-	-	-	-	-	4	-	-	2	-	-	10	Rare
54	*Gerardiana palmata* (Forssk.) Gaud.	-	-	2	-	-	-	2	-	-	-	2	-	-	0	-	-	-	-	6	Vulnera[redacted]le
55	*Gerbera gossypina* (Royle) Beauv.	-	1	-	-	-	-	2	-	-	-	-	3	-	-	-	-	-	4	10	Rare
56	*Geum elatum* L.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	-	-	-	4	11	Rare
58	*Grewia optiva* Drum. Ex Burret.	0	-	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	0	Endange[redacted]red
59	*Hedra helix* L.	-	1	-	-	-	1	-	-	0	-	-	-	-	0	-	-	-	-	2	Endange[redacted]red
60	*Hedra nepalensis* K. Koch.	-	1	-	-	-	1	-	-	0	-	-	-	-	0	-	-	-	-	2	Endange[redacted]red
61	*Hypericum perforatum* L.	-	-	2	-	-	-	2	-	-	-	-	3	-	-	-	-	3	-	10	Rare
62	*Imaptiens balsiminea* Linn.	-	-	-	3	-	-	-	3	-	-	-	-	4	-	-	-	-	4	14	Infreque[redacted]nt
63	*Impatiens edgeworthii* Hk. F.	-	-	-	3	-	-	-	3	-	-	-	-	4	-	-	-	-	4	14	Infreque[redacted]nt
64	*Impatiens gigantea* Egew.	-	-	2	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	13	Infreque[redacted]nt
65	*Impatiens parviflora* DC.	-	-	2	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	13	Infreque[redacted]nt
66	*Indigofera hetrantha* Wall.	-	1	-	-	-	1	-	-	-	-	-	3	-	0	-	-	-	-	5	Vulnera[redacted]le
67	*Inula grantioides* Boiss.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	-	-	3	-	10	Rare
68	*Ipomea palmata* Forssk.	-	-	2	-	-	1	-	-	-	-	-	-	4	-	-	-	3	-	10	Rare
69	*Ipomea purpura* (Linn.) Roxb.	-	1	-	-	-	1	-	-	-	-	-	-	4	-	-	-	3	-	9	Rare
70	*Juglan regia* L.	0	-	-	-	0	-	-	-	0	-	-	-	-	-	1	-	-	-	1	Endange[redacted]red
71	*Megacodon stylophorus* (C. B. Clarke)	-	1	-	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	12	Rare
72	*Melia azadarichta* Linn.	-	1	-	-	0	-	-	-	0	-	-	-	-	-	1	-	-	-	2	Endange[redacted]red
73	*Monotheca bauxifolia* (Fale) Dcne ex.	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endange[redacted]red

	Engler																				
74	*Morchella esculenta* Prs ex. Fr.	0	-	-	-	-	-	-	3	-	-	-	-	4	0	-	-	-	-	7	Vulnerable
75	*Morus alba* Linn.	-	-	2	-	0	-	-	-	-	1	-	-	-	-	-	2	-	-	5	Vulnerable
76	*Morus laevigata* Wall.	-	1	-	-	0	-	-	-	-	1	-	-	-	-	-	2	-	-	4	Endangered
77	*Morus nigra* L.	-	-	2	-	0	-	-	-	-	1	-	-	-	-	-	2	-	-	5	Vulnerable
78	*Myrtus communis* Linn.	-	-	2	-	0	-	-	-	-	-	-	3	-	-	-	2	-	-	7	Vulnerable
79	*Olea ferruginea* Royle.	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
80	*Paeonia emodi* Wall. Ex Hkf.	0	-	-	-	-	1	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
81	*Picea smithiana* (Wall.) Boiss.	0	-	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	0	Endangered
82	*Pinus gerardiana* Wall. ex Lamb.	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
83	*Pinus roxburghii* Sargent.	-	-	2	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	2	Endangered
84	*Pinus wallichiana* A. B. Jackson.	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
85	*Pisticia integrima* Stew ex. Brandis	0	-	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	0	Endangered
86	*Platanus orientalis* Linn.	0	-	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	0	Endangered
87	*Plectranthus rugosus* Wall. ex Benth.	-	1	-	-	-	-	2	-	-	-	-	3	-	0	-	-	-	-	6	Vulnerable
88	*Podophylum emodi* Wall.	-	1	-	-	-	-	-	3	-	-	-	3	-	0	-	-	-	-	7	Vulnerable
89	*Pteridium eqilinium* L.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	1	-	-	-	8	Vulnerable
90	*Pteris vitata* L.	-	1	-	-	-	-	-	3	-	-	-	3	-	-	1	-	-	-	8	Vulnerable
91	*Punica granatum* L.	-	1	-	-	-	-	2	-	-	1	-	-	-	0	-	-	-	-	4	Endangered
92	*Pyrus communis* Linn.	-	-	2	-	-	-	2	-	-	1	-	-	-	-	-	2	-	-	7	Vulnerable
93	*Pyrus pashia* Ham.	-	-	2	-	-	-	2	-	-	1	-	-	-	-	-	2	-	-	7	Vulnerable
94	*Quercus baloot* Griff.,	-	-	2	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	2	Endangered
95	*Quercus dilatata* Lindl.	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
96	*Quercus incana* Roxb.	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
97	*Quercus lanata* Smith,	-	-	2	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	2	Endangered
98	*Quercus semicarfifolia* Sm.	-	-	2	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	2	Endangered

99	*Robinia pseudocacia* Linn.	-	1	-	-	0	-	-	-	-	-	-	3	-	0	-	-	-	-	4	Endangered
100	*Rosa macrophylla* Lindl.	-	-	2	-	-	1	-	-	-	-	-	3	-	-	-	-	-	4	10	Rare
101	*Rubus ellipticus* Smith.	-	-	2	-	-	1	-	-	-	-	2	-	-	-	-	-	-	4	9	Rare
102	*Rubus foliolosus* D. Don	-	-	2	-	-	1	-	-	-	-	2	-	-	-	-	-	3	-	8	Vulnerable
103	*Rubus fruticosus* L.	-	-	2	-	-	1	-	-	-	-	2	-	-	-	-	-	3	-	8	Vulnerable
104	*Rubus sanctus* Schreb.	-	-	2	-	-	1	-	-	-	-	2	-	-	-	-	-	3	-	8	Vulnerable
105	*Salix babylonica* L.	-	1	-	-	0	-	-	-	-	1	-	-	-	0	-	-	-	-	2	Endangered
106	*Salix tetrasperma* Roxb. Pl. Corom.	-	-	2	-	0	-	-	-	-	1	-	-	-	0	-	-	-	-	3	Endangered
107	*Salvia lanata* Roxb	-	1	-	-	-	-	-	3	-	-	-	-	4	0	-	-	-	-	8	Vulnerable
108	*Salvia moorcroftiana* Wall.	-	-	2	-	-	-	-	3	-	-	-	-	4	-	-	-	3	-	12	Rare
109	*Salvia nubicola* Wall.	-	1	-	-	-	-	-	3	-	-	-	-	4	0	-	-	-	-	8	Vulnerable
110	*Sarcococca saligna* (D.Don) Muell.	-	-	2	-	-	1	-	-	-	1	-	-	-	0	-	-	-	-	4	Endangered
111	*Sauromatum venosum* (Aiton) Kunth	-	1	-	-	-	1	-	-	-	-	-	-	4	-	-	-	-	4	10	Rare
112	*Saussoria albescens* (DC) Sch. Bip.	-	1	-	-	-	-	-	3	-	-	-	-	4	-	-	-	3	-	11	Rare
113	*Segeretia thea* (L.) Brongn.	0	-	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	0	Endangered
114	*Spiraea Lindleyana* Wall.	0	-	-	-	-	-	2	-	-	1	-	-	-	0	-	-	-	-	3	Endangered
115	*Stachys emodi* Hedge (S. I. Ali & Y. J. Nasir)	0	-	-	-	-	-	2	-	-	1	-	-	-	0	-	-	-	-	3	Endangered
116	*Stachys seriaca* Wall. ex Benth.	0	-	-	-	-	-	2	-	-	1	-	-	-	-	-	-	3	-	6	Vulnerable
117	*Thalictrum pendunculatum* Edgew.	0	-	-	-	-	-	-	3	-	-	-	-	4	-	-	-	3	-	10	Rare
118	*Thymus serphylum* Benth.	-	1	-	-	-	-	-	3	-	1	-	-	-	0	-	-	-	-	5	Vulnerable
119	*Urtica dioica* Linn.	-	1	-	-	-	-	-	3	-	-	-	-	4	-	-	-	-	4	12	Rare
120	*Urtica hyperborea* L.	-	1	-	-	-	-	-	3	-	-	-	-	4	0	-	-	-	-	8	Vulnerable
121	*Valeriana* spp.	0	-	-	-	-	-	2	-	-	-	-	-	4	0	-	-	-	-	6	Vulnerable
122	*Verbascum thapsis* L.	-	1	-	-	-	-	2	-	-	-	-	-	4	-	-	-	-	3	10	Rare
123	*Vibernum grandiflorum* Wall. Ex DC.	-	1	-	-	0	-	-	-	-	1	-	-	-	0	-	-	-	-	2	Endangered

124	*Viola biflora* L.	-	1	-	-	-	-	-	3	-	-	-	-	4	0	-	-	-	-	8	Vulnerable
125	*Viola serpens* Wall. Ex Roxb.	-	1	-	-	-	-	-	3	-	-	-	-	4	0	-	-	-	-	8	Vulnerable
126	*Woodfordia fruticosa* (L.) Kurz.	-	1	-	-	0	-	-	-	0	-	-	-	-	0	-	-	-	-	1	Endangered
127	*Zanthoxylum armatum* DC.	-	1	-	-	-	-	-	3	0	-	-	-	-	0	-	-	-	-	4	Endangered

Conclusions

The study revealed that Chakesar valley had 319 species of plants belonging to 85 families and 215 genera. There were 75 families having 178 genera, 276 species of dicot while 5 families with 26 genera and 30 species were monocot. Only one family with 3 genera and 5 species of gymnosperms were known. Poaceae and Asteraceae had the highest number of species. The valley had also 51.4% medicinal plants, 27.3% fodder plants, 18.5 % fuel species, 14.7 % timber wood, 14.1 % pot herbs and 19.8 %were plants used as veterinary folk medicines.

Qualitative and quantitative description of different plant communities in various sites has provided some basic information about phytodiversity, vegetation-edaphic and climatic complex. Summer season had rich vegetation with high species richness, diversity and communities had also high % of maturity index values. the species had also shown even distribution in this season. Oona hills show more distributed communities than other stands. *Ailanthus altissima* an exotic species reached to the hill top and has replaced natural forests of *Pinus wallichiana* and *Quercus* spp. The soil is sandy loam with slight acidic in environment. EC values decrease with altitude. Temperature, humidity decreases with altitude and moisture and radiation increase with elevation. DCA analysis recognized 5 groups of plants which identified the vegetation groups showing appropriate edaphic and climatic conditions but biotic interferences had deformed vegetation composition and structure.

Gumrush hills had well suited environmental conditions which prevailed in the site and had little modified conditions in foot hill area. The mid hill vegetation well flourished in the prevailing conditions. Disturbances are more pronounced in foot hill and hill top. As elevation increases, settlement decrease which also decrease anthropogenic activities and shift disturbed habitats to natural vegetation. Hill top reflected images of subtropical vegetation.

Bakht Banda located at high altitude and had very extreme environmental conditions, make it inaccessible in turn it exists in natural conditions. It had well developed and mature communities. It has moist temperate forests. In Garang woody species population has different dynamics. Most species had shown regeneration but low

and improper recruitment. The main causative agents are overgrazing, browsing, deforestation, race for holding more lands.

Dhali site close to inhabitants and it had deformed shape of vegetation and mostly reflected scrubby forest. The low basal area of trees was recorded and described change of habitats and human disturbances in form of cutting of trees, uprooting of shrubs and leveling of land for cultivation.

The major bulk of plants are grazed. Among the palatable species there were 32.0% highly palatable. Among the highly palatable 86.3% herbs, 3.9% shrubs and 9.8% trees. The less palatable species had 26% contribution, which included 47 % herbs, 26 % shrubs and 18% trees.

Fourteen species were analyzed for 13 important minerals including trace, heavy and essential metals at three phenological stages. Trace elements include copper, zinc, manganese, nickle, iron and sodium. Macro nutrients included Phosphorus, Potassium. Calcium and Magnesium.

In proximate analysis moisture (%), nitrogen (%), crude protein (CP), crude fibers (CF), ether extract (EE), ash, carbohydrates, hemicellulose, Neutral detergent fiber (NDF), acid detergent fiber (ADF) and nitrogen free extract (NFE) were analyzed and estimated in the selected 14 plants.

Based on IUCN criteria class seen that of the 127 most important medicinal plants 47 (37%) species were endangered, 32 (25 %) vulnerable, 36 (28 %) rare and 12 (9%) species are infrequent.

General Recommendations

1. Chakesar Valley, district Shangla has been remained out of sight of Scientists so far. It is because of remote and backward area and lack of transportation. The concerned bodies should give attention to solve the problems and scientists especially biologists and geologists should devote more time to look at on.
2. It is seen that influential people had rich communities in forests as they owned than forests control and look after by government institutions. These forests should be given to the influential people so that they properly manage, look after and control the cutting.
3. Regeneration capacity of woody tree speciesis very poor in most of the foot hill and some where even in mid of the hills. Government should distribute saplings each year among the villagers to plant them.
4. Government should have to establish nurseries in such area to practice the propagation of high price and valued plants.
5. Interested people should be trained regarding forestry and horticulture.
6. Medicinal plants should be cultivated on large scale and it should be a source of income.
7. People should be educated and to run awareness campaign among them to grow medicinal plants.
8. Practices should carry on sericulture practices.
9. To enhance the literacy rate
10. To use media to save nature and its importance.
11. To initiate small scale schemes for the benefit of the people of the area so that they explore new ways of earning and pressure on natural forests turn down.
12. To take measure to improve their livelihood. It can be achieved only when new and attractive means of employment find out.
13. Regeneration status of some medicinal plants is in poor condition of regeneration and these plants should be given priority for conservation.
14. Even though some remote hills like Benja, Martung which were not included in the study. Detail vegetation analysis and ethnobotanical potential study is highly recommended.

Abbas, H., M. Qaiser and J. Alam. 2010. Conservation status of Candaba hetrotricha Stocks (Cappiridaceae): Ann endangered species in Pakistan. *Pak. J. Bot.*, 42(1): 35-46.

Abbasi, M. K., M. M. Tahir, A H. Shah and F. Batool. 2009. Mineral nutrient composition of different ecotypes of white clover and their nutrient credit to soil at Rawalakot Azad Jammu and Kashmir, *Pak. J. Bot.*, 41(1): 41-51.

Abdullahi, M. B., S. S. Sanusi, S. D. Abdul and F. B. J. Sawa. 2009. An assessment of the herbaceous species vegetation of Yankari Game Reserve, Bauchi, Nigeria. *American-Eurasian J. Agric. & Environ. Sci.*, 6 (1): 20-25.

Abuodha, J. O. Z., W. M. Musila and H. Van Der Hagen. 2003. Floristic composition and vegetation ecology of the Malindi Bay coastal dune field, Kenya. *Journal of Coastal Conservation*, 9 (2): 97-112.

Adam, J. H. and Z. Mamat. 2005. Floristic composition and structural composition of lime stone forests at three different elevations in Bau, Kuching, and Sarawak, Malaysia. *J. Biol. Sci.*, 5(4): 478-485.

Adam, J. H., A. M. Mahmud, N. Edy Muslim, H. A. Hamid and M. A. Jalaludin. 2007. Cluster analysis on floristic composition and forest structure of hilly lowland forest in Lok Kawi, Sabah State of Malaysia. *Int. J. Bot.*, 3(4): 351-358.

Adenipekun, C.O and Oyetunji, O. J. 2010. Nutritional values of some tropical vegetables. *J. Appl. Biosci.*, 35: 2294- 2300.

Adeyeye, E. I. & M. K. O. Otokiti. 1999. Proximate composition and some nutritionally valuable minerals of two varieties of Capsicum annum. (Bell and Cherry peppers). Discovery and Innovation, 11:75-81.

Adhikari, B.S., M. Joshi, H.C. Rikhari & Y.S. Rawat. 1992. Cluster Analysis (Dendrogram) of high altitude (2150-2500 m) forest vegetation around Pindari glacier in Kumaun Himalaya. Journal of Environmental Biology 13: 101-105.

Adnan, M., J. Hussain, M. T. Shah, Z. K. Shinwari, F. Ullah, A. Bahader, N. Khan, A. L. Khan and T. Watanabe. 2010. Proximate and nutrient composition of medicinal plants of humid and sub-humid regions in North-west Pakistan. *Journal of Medicinal Plants Research*, 4(4):339-345.

Adnan, S. M., A. A. Khan, A. Latif and Z. K. Shiwari. 2010. Threats to the sustainability of ethno-medicinal uses in Northern Pakistan (A Case Study of Miandam Valley, District Swat, N.W.F.P. Province, Pakistan). 30(1): 25–32.

Adnan, S. M., A. A. Ashiq, L. K. Abdul and K. S. Zabta. 2006. Threats to the sustainability of ethno-medicinal uses in Northern Pakistan; a case history of Miandam valley, district Swat, NWFP, Pakistan. *Lyonia.* 11 (2): 91-100.

Agra, M. F., G. S. Barach, K. Nurit, I. J. L. D. Dasilio and V. P. M. Coelho. 2007. Medicinal and poisonous diversity of the flora of Cariri Paraibano, Brazil. *Journal of Ethnopharmacology,* 111 (2007): 383 – 395.

Ahas, R., A. Aasa, A. Menzel, V. G. Fedotova, Scheifinger H., 2002. Changes in European Spring phenology. *Int. J. Climatol.*, 22, 1727- 1738.

Ahmad, I., M. Arshad and H. Bibi. 2001. Phytogeographical distribution of vegetation in desert area of Islamia University, Bahawalpur. *J. Biol. Sci.*, 1 (8): 768-771.

Ahmad, K., Z. I. Khan, M. Ashraf, E. E. Valeem, Z. A. Shah and L. R. Mcdowell. 2009. Determination of forage concentrations of lead, nickel and chromium in relation to the requirements of grazing ruminants in the salt range, Pakistan. *Pak. J. Bot.*, 41(1): 61-65.

Ahmad, K., Z. I. Khan, M. Ashraf, M. Hussain, M. Ibrahim and E. E.I. Valeem. 2008. Status of plant diversity at Kufri (Soone valley) Punjab, Pakistan and prevailing threats therein. *Pak. J. Bot.*, 40(3): 993-997.

Ahmad, K., Z. I. Khan, M. Y. Ashraf, M. Ashraf and E. E. Valeem. 2008. Forage evaluation for some trace elements: a case study in the Soone Valley, Pakistan. *Pak. J. Bot.*, 40(3): 999-1004.

Ahmad, M., 1. Islam, G. Bano, and S. Koukab. 2009. Seasonal variation in current season and dead biomass of *Chrysopogon aucheri* (boiss) stapf. and *Cymbopogon jwarancusa* (jones) schult. In highland balochistan, pakistan, *Pak. J. Bot.*, 41(2): 519-527.

Ahmad, M., M. A. Khan, M. Arshad and M. Zafar. 2004. Ethnophytotherapical approaches for the treatment of diabetes by the local

inhabitants of District Attock (Pakistan). *Journal of Ethnobotanical leaflets*, SIUC, USA.

Ahmad, M., M. A. Khan, M. Zafar and S. Sultana. 2006. Ethnomedicinal demography and ecological diversification of some important weeds from District Attock, Pakistan. *Pak. J. Weed Sci. Res.*, 12 (1-2): 37-46.

Ahmad, S. and Z. D. Khattak. 2001. Quantitaive study of the vegetation of Islamabad. *Pak. J. Sci. Ind. Res.*, 44(5): 279-285.

Ahmad, S. S and S. Z. Hussain. 2008. Ethno medicinal survey of plants from Salt range (Kallar Kahar) of Pakistan, *Pak. J. Bot.*, 40(3): 1005-1011.

Ahmad, S. S and T. Yasmin. 2011. Vegetation classification along Hanna lake, Baluchistan using ordination techniques. *Pak. J. Bot.*, 43(2): 863-872.

Ahmad, S. S., A. Wahid and K. F. Akbar. 2010. Multivariate classification and data analysis of vegetation along motorway (M-2), Pakistan, *Pak. J. Bot.*, 42(2): 1173-1185.

Ahmed, M. 1988a. Plant communities of some northern temperate forests of Pakistan. *Pak. J. For.*, 38: 33-40.

Ahmed, M. T. Husain, A.H. Sheikh, S. S. Hussain and M. F. Siddiqui. 2006. Phytosociology and structure of Himalayan forests from different climatic zones of Pakistan. *Pak. J. Bot.*, 38(2): 361-383.

Ahmed, S. S and S.H. Hasan. 2008. Ethnomedicinal survey of plants from Salt range (Kallar Kahar) of Pakistan. *Pak. J. Bot.*, 40: 1005-1012.

Ajaib, M., Z. Khan, S. Muhammad and R. Mahmood. 2008. Biological spectra of Saney Baney Hills, District Kotli, Azad Jammu and Kashmir. *Pak. J. Sci.*, 60(1): 53-58.

Akeroyd, J. 2002. A rational look at extinction. *Plant Talk*, 28: 35-37.

Akhtar, N. and S. Begum. 2009. Ethnopharmacological important plants of Jalala, District Mardan, Pakistan. *Pak. J. Pl. Sci.*, Vol. 15 (2): 95-100.

Alam, N., Z. K. Shinwari, M. Ilyas and Zahid Ullah. 2011. Indigenous knowledge of medicinal plants of Chagharzai Valley, District Buner, Pakistan. *Pak. J. Bot.*, 43(2): 773-780.

Chapter 5 **References**

Alhassan, A.B., A. K. Chiroma and A. M. Kundiri.2006. Properties and classification of soils of Kajimaram Oasis of Northeast Nigeria. *Int. J. Agric. Biol.*, 8: 256–261.

Ali, H. and M. Qaiser. 2009. The ethnobotany of Chitral Valley, Pakistan with a particular reference to medicinal plants. *Pak. J. Bot.*, 41(4): 2009-2041.

Ali, I., J. P. Fontenot and V. G. Allen. 2009. Palatability and dry matter intake by sheep fed corn stover treated with different nitrogen sources. *Pak. Vet. J.*, 29 (4): 199-201.

Ali, J and A. B. Tor. 2004. Fuelwood, timber and deforestation in the Himalayas: The case of Basho valley, Baltistan region, Pakistan. Mountain Research and Development. 24(4):312–318.

Al-Yemeni, M. N., H. Sher. Biological spectrum with some others ecological attributes of the flora and vegetation of the Asir Mountain of South West, Saudi Arabia. Afr J Biotechnol 2010; 9(34): 5556-5565.

Amusa, T. O. and S. O. Jimoh. 2010. Ethnobotany and conservation of plant resources of Kainji Lake National Park, Nigeria. *Ethnobotany Research & Applications*, 8 (2010).

Anderson, E. W and R. J. Scherzinger. 2001. Improving quality of winter forage for elk by cattle grazing. *J. Range Manage.* 28:120-125.

Anonymous. 2006. *Economic Survey*. Government of Pakistan, Finance Division, Islamabad, Pakistan. Rehman, A. 1995. *The potential for the use of salt bush in sheep grazing systems during summer and autumn in a Mediterranean climate*. Ph.D. Thesis, University of Western Australia.

AOAC (Association of Official and Analytical Chemistry). 2000. Official methods of analysis (by Dr. William Horwitz) 17th Ed. Gaithersburg, MD, USA.

ARC. 1980. *The Nutrients Requirements of Ruminant Livestock*. 4th edition CAB International, Wallingford, pp. 73-310.

Arshad, M and M. Ahmad. 2005b. Ethnobotanical study of Galliyat for botanical demography and bio-ecological diversification. *Journal of Ethnobotanical leaflets*, SIUC, USA.

Arshad, M. and M. Ahmad. 2005a. Medico-Botanical Investigation of Medicinally Important Plants from Galliyat Areas, NWFP (Pakistan). *Journal of Ethnobotanical leaflets*, SIUC, USA.

Ashraf, I., 1995. Phytosociological studies of Pir Chinasi Hills District Muzaffarabd. *M.Sc. Thesis*, University of Azad Jammu & Kashmir Muzaffarabad.

Ashraf, M., M. Q. Hayat, S. Jabeen, N. Shaheen, M. A. Khan and G. Yasmin. 2010. *Artemisia* L. species recognized by local community of northern area of Pakistan as folk therapeutic plants. *J. M. P. R.*, 4(2):112-119.

Askari, A., M. S. Solangi and S.I. Ahmed. 1995. Autecological studies of exotic plant *Hibiscus sabdariffa* L. (Roselle), a multipurpose plant, for its introduction and culture. *Pak. J. Sci. Ind. Res.*, 38(1): 17-21.

Asri, Y. 2003. Plant diversity in Touran Biosphere Rservoir, Vol.305. p306. Publishing research institute of forests and rangelands, Tehran, Iran.

Auda, M. A and E. S. Ali. 2010. Cadmium and zinc toxicity effects on growth and Mineral nutrients of carrot (*Daucus carota*). *Pak. J. Bot.*, 42(1): 341-351.

Awan, A . 2000 . Fuel wood conservation in rural household of Tehsil Attok. *Pak. J. For.*, 50: 109-110.

Awan, M.R. (1999-2001). Studies on Taxonomy and Traditional uses of Economically Important Plants of Chitral. Final Research Report. Project No. C-PMNH/Bio (295). Pakistan Museum of Natural History Islamabad. pp. 199.

Ayaz A., 1998. Annual technical report, people and plants nitiative conservation and Training in Applied Ethnobotany, Pakistan, WWF Pakistan 1997:42-56.

Ayoola, P. B., A. Adeyeye and O. O. Onawumi. 2010. Trace Elements and Major Minerals Evaluation of *Spondias mombin,Vernonia amygdalina* and *Momordica charantia* Leaves. *Pakistan Journal of Nutrition.* 9 (8): 755-758.

Azim, A., Z. Naseer and A. Ali. 1989. Nutritional evaluation of maize fodder at two different vegetative stages. *Aust. J. Agric.Res.*, 2:27 -34.

Badshah, L and F. Hussain. 2011. People preferences and use of local medicinal flora in District Tank, Pakistan. *Journal of Medicinal Plants Research*, 5(1): 22-29.

Chapter 5 **References**

Badshah, L. and N. Hussain. 2008. Indigenous remedies for woman and child diseases in the village Tabai South Waaziristan, Pakistan. *Pak. J. Pl. Sci.*, 14(2):97-100.

Badshah, L., F. Hussain and M. J. Durrani. 2004. Ethnoecological profile of plants of South Waziristan, Pakistan. *Pak. J.Pl. Sci.*, 10(2):109-118.

Badshah, L., F. Hussain and Z. Muhammad. 1996. Floristic and ethnoecological studies on some plants of Pirghar hills, S. Waziristan, Pakistan. *Pak. J. Pl. Sci.*, 2(2): 167- 177.

Baligar, V. C., N. K. Fageria, and Z. L. He. 2001. Nutrient use efficiency in plants. *Commun. Soil Sci. Plant anal.*, 32(7&8), 921–950.

Banjska, G. 1977. Incidence on alfalfa fields in SAP Kosovo. Fragmenta Herbologica Jugoslavica, III (1): 39-48.

Bano, G., M. Islam, S. Ahmad, S. Aslam and S. Koukab. 2009. Seasonal variation in nutritive value of *Chrysopogon aucheri* (Boiss) Stapf., and *Cymbopogon Jwarancusa* (Jones) Schult. in highland Balochistan, Pakistan. *Pak. J. Bot.*, 41(2): 511-517.

Barkatullah, M. Ibrar and F. Hussain. 2009. Ethnobotanical studies of plants of Charkotli Hills, Batkhela District, Malakand, Pakistan. Frontiers of Biology in China. 4(4): 539-548.

Batalha, M. A. and W. Mantovani. 2001. Floristic composition of the Cerrado in the Pé-De-Gigante Reserve (Santa Rita Do Passa Quatro, Southeastern Brazil). *Acta Botanica Brasilica*, 15(3): 22-30.

Batlaha, M. A., F. R. Martins. 2005. Life form spectra of Brazilian cerrado sites. *Forest Ecology & Management*, 217 (1):103-116.

Beg, A. R and M. H. Khan. 1980. Present situation and the future of dry Oak Forest Zone in Pakistan. *Pak. J. For.*, 30: 109-122.

Beg, A. R., 1978. Vegetation; chapter XI. In. causes effects and remedies of poppy cultivation in Swabi Gadoon area. Vol. 1 (ed) N. Mian. Board of economic inquiry, university of Peshawar. Pp. 269-300.

Beg, A.R. and M. H. Khan. 1984. Some more plant communities and the future of dry oak forest zone in Swat valley. *Pak. J. Forest*, 34: 25-35.

Beg. A. R. 1974. Vegetation on the Scree slopes of Chitral Gol. *Pak. J. For.*, 24(2): 393-402.

Belewu, M. A and F. T. Babalola. 2009. Nutrient enrichment of waste agricultural residues after solid state fermentation using Rhizopus oligosporus. *Journal of Applied Biosciences.* 13: 695 - 699.

Berg, V. D., Eduardo and Oliveira-filho, T. Ary. 2000. Floristic composition and phytosociological structure of a riparian forest in Itutinga, State of Minas Gerais, Brazil, and comparisons with other areas. *Rev. Bras. Bot.*, 23 (3): 231-253.

Biswas, S. R.and K. Misbahuzzaman. 2008. Tree species diversity and regeneration traits of the dominant species in a dipterocarp forest in Bangladesh: implications for conservation. *International J. Biodiversity Science, Ecosystems Services & Management,* 4(2): 81 – 91.

Black, C. A. 1968. Soil Plant Relations. J. Wiley and Sons. New York.

Bliss, L. C.1962. Rosine and lipid contents in alpine Tundra plants. *Ecology*, 43: 753-757.

Bocuk, H., C. Ture and O. Ketenoglu. 2009. Plant diversity and conservation of the Northeast Phrygia region under the impact of land degradation and desertification (Central Anatolia, Turkey). *Pak. J. Bot.*, 41(5): 2305-2321.

Bonet, M. A and J. Valles. 2007. Ethnobotany of Montseny biosphere reserve (Catalonia, Iberian Peninsula): plants used in veterinary medicine. *J. Ethnopharmacol.*, 110(1):130-47.

Bors, L. U. H. and G. Jasper. 1992. Commercial vegetable processing. Table-15.6. AVI Pub. Comp. Inc., West port, Conneticut. Phytoconstituents, proximate and nutrient investigations of *Saba florida* (Benth.) from Ibaji forest. *International Journal of Nutrition and Metabolism.* 2(5): 88-92.

Bramwell, D. 2002. How many plant species are there? *Plant Talk,* 28: 32-34.

Braun-Blanquet, J. 1932. Plant Sociology. Translated by G.D.Fuller and H.S. Conard. (1965). McGraw Hill Book Co. Inc., New York.

Brinkmann, K., A. Patzelt, U. Dickhoefer, E. Schlecht and A. Buerkert. 2009. Vegetation patterns and diversity along an altitudinal and a grazing gradient in

the Jabal al Akhdar Mountain range of Northern Oman. *J. Arid Environments,* 73:1035 –1045.

Brinson, M.M. 1990. Reverine Forests. In: Ecosystems of the Worlds 15. *Forested Wetlands.* (Eds.): M. Lugo, M. Brinson and S. Brown. Oxford: Elsevier.

Buckman, H.O and N. C. Brady. 1967. The nature and properties of soils. Eurasia Publishing House (Pvt) Ltd. New Delhi.

Butler, D. W., R. J. Fairfax and R. J. Fensham. 2005. Impacts of tree invasion on floristic composition of subtropical grasslands on the Bunya Mountains, Australia. *Australian J. Botany,* 54(3) 261–270.

Cain, S. A and G. M. De Oliveria Castro. 1959. Manual of Vegetation Analysis. Harper & Brothers, New York.

Cattanio, J. H., A. B. Anderson and M. S. Carvalho. 2002. Floristic composition and topographic variation in a tidal floodplain forest in the Amazon Estuary. *Rev. Bras. Bot.*, 25(4): 67- 77.

Cayuela L., J. M. R. Benayas, F. T. Maestre and A. Escudero. 2008. Early environments drive diversity and floristic composition in Mediterranean old fields: Insights from a long term experiment. *Acta Oecologica.* 34: 311-321.

Census Report of District Shangla. 2000. Population census organization, Statistical Division Govt. Pak, Islamabad pp. 10-89.

Champion, H. G, S. K. Seth and G. M. Khattak, 1965. *Forest Types of Pakistan.* Pakistan Forest Institute, Peshawar.

Chasapis, M., V. Karagiannakidou and K. Theodoropoulos. 1992. Phytosociological research of *Quercus coccifera* L. pseudomaquis on Mount Chortiatis, northern Greece. *Is. J. Pl. Sci.*, 73(1-4): 133-143.

Chaudhry, M. I., M. A. Khan and A. Shah. 2004. Plants used for family planning and sex disease treatment in Samahni Valley, Pakistan. *J. Ethnobotanical Leaflets* (http://www.siu.edu/~ebl/).

Cheema, T. A., S. Muhammad, Z. Basheer and R. Mehmood. 2005. Phytosociological analysis of weeds of potato field in Tehsil Gojra District Toba tek Sing. *Pak. J. Pl. Sci.*, 11(2): 159-162.

Cheema, U. B., J. I. Sultan, A. Javaid, P. Akhtar and M. Shahid. 2011. Chemical composition, mineral profile and *in situ* digestion kinetics of fodder leaves of four native trees. *Pak. J. Bot.*, 43(1): 397-404.

Chernery, D. J. R., J. H. Cherney and R. F. Lucey. 1993. *In vitro* digestion kinetics and quality of perennial grasses as influenced by forage maturity. *J. Dairy Sci.*, 76: 790-797.

Chmielewski, F. M., Rotzer T., 2001: Response of tree phenology to climate change across Europe. *Agric. For. Meteorol.*, 108, 101-112.

Chaughtai, S. M., J. Shah, S. Z. Shah and S.H. Shah. 1987. Vegetation of the flood plains of river Indus near Attock Khurd, Punjab, Pakistan. *The Pak. J. Fores.*, pp125- 130.

Chaughtai, S. M., S. Z. Shah and J. Shah. 1989. Temporal changes in vegetation of Miranjani top Galis, Hazara, NWFP. Pakistan. *Pak. J. Bot.*, 21(1): 107-117.

Clark, P. E., W.C. Krueger, L.D. Bryant, and D.R. Thomas. 1998. Spring defoliation effects on bluebunch wheatgrass: II Basal area. *J. Range Manage.* 51:526-530.

Claude, B and Paule Solomon, 1979. The manual of Natural living. 1 Ed. Biddles Ltd, Guildford, Surrey, pp: 98-101.

Clovis, E. S., N. Maria, J. N. Rodal and A. C. Cavalcanti. 2003. Phytosociology of the remaining xerophytic woodland associated to an environmental gradient at the banks of the Sao Francisco River - Petrolina, Pernambuco, Brazil. *Revista Brasil. Bot.*, 26(3): 271-287.

Cox, G. W. 1967. *Laboratory Manual of General Ecology.* Wm. C. Brown Co. Publishers, Lowa. 105p.

Da Costa, R.C., F. S. de Arau, L.W. Lima-Verde. 2007. Flora and life-form spectrum in an area of deciduous thorn woodland (caatinga) in Northeastern Brazil. J. *Arid Environments,* 68 (2007):237 –247.

Dahare, D. K. and A. Jain. 2010. Ethnobotanical studies on plant resources of Tahsil Multai, District Betul, Madhya Pradesh, India. *Ethnobotanical Leaflets,* 14:694-705.

Dansereau, P. 1951. Description and recording of vegetation upon a structural basis. *Ecology*, 32 (2): 172-229.

Dar, G. H., R. C. Bhagat and M. A. Khan. 2001. Biodiversity of Kashmir Himalaya. Valley Book House, Srinagar, J & K, India.

Das, P., L. P. Devi and M. Gogoi. 2009. Nutrient Composition of Some Regional Recipes of Assam, India. *Ethno-Med*, 3(2): 111-117.

Dastagir, G. and I. Haq. 2002. Phytosociology of Mai Dhani Hill near Muzaffarabad, Azad Kashmir. II. Winter vegetation. *Pak. J. Sci. & Ind. Research*, 45 (4): 227 – 283.

Dastagir, G., I. Haq, Z. H. Malik. 1999. Phytosociology of Mai Dhani hill near Muzaffarabad, Azad Kashmir. *Pak. J. Biol. Sci.*, 2(1): 185-191.

Dasti, A. A. and S. A. Malik. 2000. A transect of vegetation and soils on the Indus Valley Slope, Pakistan. *Pakistan J. Pl. Sci.*, 4: 73–84.

data of Ayub National Park, Rawalpindi. *Soil and Environment.*, 28(2): 106-112.

Daubenmire, R. 1959. A canopy coverage method of vegetation analysis. *Northwest Sci.*, 33:43-46.

Davis, W. 1991. Towards a new synthesis in ethnobotany. In: Rios, M. And Pederson, H. B.(eds.), Las planta yel hombre – *Memorias del Primer Simposio Ecuatoriano de ethnobotanica y Botanica economica*, pp. 339- 357. Ediddiones A bya- yala, Quito, equador.

De Brito, A., M. Z. Ferreira, J. M. De Mello, J. R. S. Scolforo, A. D. De Oliveira and F. W. A. Junior. 2007. Comparison between the quadrants and prodan methods for floristic, phytosociologic and volumetric analysis. *Cerne, Lavras*, 13(4): 399-405.

De Lange, P. J., D. A. Norton, S. P. Courtney, P. B. Heenan, J. W. Barkla, E. K. Cameron, R. Hitchmough and A. J. Townsend. 2009. Threatened and uncommon plants of New Zealand (2008 revision), *New Zealand Journal of Botany, 47:61–96.*

De Souza, A. L., S. Stanley, J. R. Moraes de and V. A. Bartolomeu do. 2002. Floristic composition dynamics of a secondary dense ombrophylous forest, after vine cutting, at the Vale do Rio Doce S.A. Natural Reserve in Espirito Santo, Brazil. *Rev. Arvore*, 26 (5): 549-558.

Decamps, H. and E. Tabacchi. 1994. Species richness in vegetation along river margins. In: *Aquatic Ecology*: Scale Patterns and Processes. (Eds.): P.S. Giller, A. Hildrew and D.D. Rafaelli. Oxford: Blackwell Scientific Publications.

Deka, D., P. Saikia and D. Konwer. 2007. Ranking of fuel wood species by fuel value index. *Energy sources,* Part A, 29: 1499-1506.

Dilshad, S. M. R., N. U. Rehman and A. Iqbal. 2009. Documentation of ethnoveterinary practices for Mastitis in Dairy Animals in Pakistan. *Pakistan Veterinary Journal.* 2074-7764, (ONLINE).

Dombois, D. M and H. Ellenberg.Aims and Method of Vegetation Ecology. John Wiley and Sons, New York, USA. 1974.

Dos Santos, R. M., F. D. Vieira, E. Gusmao and Y. R. F. Nunes. 2007. Floristic and structure of a seasonal deciduous forest, in the "Parque Municipal Da Sapucaia" Montane claros. *Cerne, Lavras,* 13(3): 248-256.

Du Rietz, G. E. 1931. Life-forms of terrestrial flowering plants. I. *Acta Phytogeographica Suecica,* 3 (1): 95.

Dua, K. and A.D. Care. 1995. Impaired absorption of magnesium in the etiology of grass tetany.*Brit. Vet. J.*, 151: 413-26.

Ducic, T and A. Polle. 2005. Transport and detoxification of manganese and copper in plants. Braz. J. Plant Physiol. 17, 103-112.

Dumlu, M. and E. Gurkan . 2007. Elemental and nutritional analysis of *Punica granatum* from Turkey. *J. Med Food,* 10(2):392-5.

Durrani, M. J and M. Manzoor. 2006. Ethnobotanical study of some plants of S. B. K. Women University Quetta, Pakistan. *Pak. J. Pl. Sci.*, 12 (1): 83-87.

Durrani, M. J. and A. Razaq. 2010. Floristic diversity, ecological characteristics and ethnobotanical profile of plants of Aghberg rangelands, Baluchistan, Pakistan. *Pak. J. Pl. Sci.*, 16(1):29-36.

Durrani, M. J. and F. Hussain. 2005. Ethnobotanical profile of plants of Harboi rangelands, Kalat, Pakistan. *Int. J. Biol. Biotech.*, 2: 15-22.

Durrani, M. J., A. M. Taj and F. Hussain. 2003. Folk medicinal plants of Noshki, District Chaghi, Pakistan. *J. Sci. Techn.*, 27: 45-51.

Durrani, M. J., M. Manzoor and S.Irfan. 2009. Folk uses of some plants of Quetta, Pakistan. *Pak. J. Pl. Sci.*, 15 (1): 1 – 9.

Ecological determinants of plant species richness at local scale in Mediterranean forests. *Plant Biosyst.* 142, 630–642.

Egler, Frank. E. 2004. Vegetation science concepts I. Initial floristic composition, a factor in old-field vegetation development with 2 figs. *Plant Ecology*, 412-417.

El-Darier, S. M. and F. M. El-Mogaspi. 2009. Ethnobotany and relative importance of some endemic plant species at El-Jabal El-Akhdar region (Libya). *World Journal of Agricultural Sciences,* 5 (3): 353-360.

El-Ghanim, W. M. L. M. Hassan, T. M. Galal, A. Badr. 2010. Floristic composition and vegetation analysis in Hail region north of central Saudi Arabia. *Saudi Journal of Biological Sciences,* 17, 119–128.

Encinas, J. I., L. A. De Macede and J. E. De Paula. 2007. Floristic composition and phytosociology of a semi deciduous seasonal forest stand in the Cerrado Ecomuseum, Goias. *Cerne Lavras,* 13 (3): 308-320.

Enright, N. J., B. P. Miller and R. Akhter. 2005. Desert vegetation and vegetation-environment relationships in Kirthar National Park, Sindh, Pakistan. *Jou.Arid Environments, 61*: pp397 –418.

Estrella, N., 2000: On modelling of phenological autumn phases. In Menzel, A.: *Progress in Phenology: Monitoring, data analysis, and global change impacts.* Conference abstract booklet, 49.

Estrella, N., 2003: Variations of the climatological growing season (1951-2000) in Germany compared with other countries. *Int J Climatol.*, 23, 793-812.

Ewald, J. 2003. A critique for phytosociology. *Jour. Vegetation Science,* 14(2): 291-296.

Ezcurra, C., N. Baccala and P. Wardle. 2007. Floristic relationships among vegetation types of New Zealand and the Southern Andes: Similarities and Biogeographic Implications. *Annals of Botany,* 101(9):1401-1412.

FAO (1993). Food Agricultural organization: Food and fruit bearing forest species I: examples from eastern Africa. FAO forestry paper # 44/1, FAO, Rome.

FAO. 1983. Food Agricultural organization: Food and fruit bearing forest species I: examples from eastern Africa. FAO forestry paper # 44/1, FAO, Rome.

FAO. 1997. Brahui Women's indigenous knowledge of medicinal plants. Project Report, FOGCP/ INT/542/ITA - 5.

Feldpausch, T. R., A. J. Mcdonald, C. A. Passos, J. Lehmann and S. J. Riha. 2006. Biomass, harvestable area, and forest estimated from commercial timber inventories and remotely sensed imagery in southern Amazonia. *Forest Ecology & Management,* 233 (1): 121-132.

Ferreira, L. V. 2004. Effects of flooding duration on species richness, floristic composition and forest structure in river margin habitat in Amazonian blackwater flood plain forests: implications for future design of protected areas. *J. Biodiversity & conservation,* 9(1): 1-14.

Fossati, J., G. Pautou and J. P. Peltier. 2008. Vegetation of the North-Eastern desert of Egypt. *Feddes Repertorium*, 109(3-4): 313– 327.

Ganskopp, D. and D. Bohnert. 2001. Nutritional dynamics of 7 northern Great basin grasses. *J. Range Manage.*, 54: 640-647.

Gbolahan, D., 2001. Lesson Note on medical importance of trace elements. Centre for Natural Health Studies. management of diabetes.

Ghazanfar, S. and J. Osborne. 2010. Conservation through restoration: study of a degraded gravel plain in South Eastern Arabia. *Pak. J. Bot.*, 42. 193-204.

Ghulam, D. and I. Ul Haq. 2002. Phytosociology of Mai Dhani Hill near Muzaffarabad, Azad Kashmir. II. Winter vegetation, *Pakistan Journal of Scientific and Industrial Research.* 45(4): 277-283.

Gillespie, T. W., J. Brock and C. W. Wright. 2004. Prospects for quantifying structure, floristic composition and species richness of tropical forests. *Int. J. Remote Sensing,* 25(4): 707-715.

Glaeser, C. W. 2004. The floristic composition and community structure of the forest park Woodland, Queens County, New York. *Urban Habitats,* 4(1): 102-107.

Gohl, Bo. 1981. *Tropical Feeds. Feed information summaries and nutritive values*. FAO, Animal Health and Production Series No. 12. FAO, Rome, Italy.

Guo, Q. S., X. F. Wang, G. Bar, Y. Kang, M. Hong, S. X. Pei and F. J. Zhang . 2009. Life form spectra, leaf character, and hierarchical-synusia structure of vascular plants in Thuja sutchuehensis community. *Pub Med.*, 20(9):2057-62.

Haila, Y., 2002. A conceptual genealogy of fragmentation research: from island biogeography to landscape ecology. *Ecological Applications*. 12, 321–334.

Hall, P. and K. Bawa, 1993. Methods to assess the impact of extraction of non timber tropical forest products on plant population. *Economic Botany*, 47(3), 234-47.

Hamayun, M. 2003b. Ethnobotanical studies of some useful shrubs and trees of District Buner, NWFP, Pakistan. *J. Ethnobotanical Leaflets* (http://www.siu.edu/~ebl/).

Hamayun, M. 2004. Ethnobotany of some useful trees of Hindu-Kush Mountain Region: A Case Study of Swat Kohistan, District Swat, Pakistan. *J. Ethnobotanical Leaflets.* (http://www.siu.edu/~ebl/).

Hamayun, M., A. Khan and M. A. Khan. 2005. Common medicinal folk recipes of District Buner, NWFP, Pakistan. *Journal of ethnobotanical leaflets*, SIUC, USA.

Hamayun, M., M. A. Khan and S. Begum. 2003a. Marketing of medicinal plants of Utror Gabral Valley, Swat Pakistan. *Journal of ethnobotanical leaflets*, SIUC, USA.

Hamayun, M., S. A. Khan, E. Y. Sohn and I. J. Lee. 2006. Conservation assessment of Hindu Kush Mountaineous region of Pakistan. A case study of Utror and Gabral Valley, District Swat, Pakistan. *Asian J. Pl. Sci.*, Vol. 5(4): 725-732.

Hamayun, M., S. A. Khan, E. Y. Sohn and I. J. Lee. 2006. Folk medicinal knowledge and conservation status of some economically valued medicinal plants of District Swat, Pakistan. *Lyonia*. Vol. 11(2).

Hamayun, M., S. A. Khan, I. Iqbal, G. Rehman, T. Hayat and M. A. Khan. 2004. Ethnobotanical profile of Utror and Gabral Valleys, District Swat, Pakistan. *J. Ethnobotanical Leaflets* (http://www.siu.edu/~ebl/).

Chapter 5 **References**

Hamdy, R. S., M. M. Abd El-Ghani, T. L Youssef and M. El-Sayed. 2007. The floristic composition of some historical botanical gardens in the metropolitan of Cairo, Egypt. *Afr. J. Agr. Res.*, 2(11): 610-648.

Hameed, I., G. Dastagir and F. Hussain. 2008. Nutritional and elemental analyses of some selected medicinal plants of the family Polygonaceae. *Pak. J. Bot.*, 40(6): 2493-2502.

Hameed, I., G. Dastagir and F. Hussain. 2008. Nutritional and elemental analyses of some selected medicinal plants of the family Polygonaceae. *Pak. J. Bot.*, 40(6): 2493-2502.

Hameed, I., G. Dastagir and F. Hussain. 2008. Nutritional and elemental analysis of some selected medicinal plants of family polygonaceae. *Pak. J. Bot.*, 40(6):2493-2502.

Hamzaoolu, E. and A. Aksoy. 2001. Phytosociological Studies on the Halophytic. Communities of Central Anatolia. *Ekoloji*. 18(71):1- 14.

Hanninen, H., R. Hakkinen, P. Hari and V. Koski. 1990. Timing of growth cssation in rlation to climatic adaptation of northern woody plants. *Tree physiol.*, 6: 29-39.

Hans Ter Steege, H., D. Sabatier, H. Castellanos, T. Van Andel, J. Duivenvoorden , A. Adalardo de Oliveira, R. Ek, R. Lilwah, P. Maas and S. Mori. 2000. An analysis of the floristic composition and diversity of Amazonian forests including those of the Guiana shield. *J. Tropical Ecology*, 16(6): 801-828.

Hansen, K. and J. Jansen. 1972. The vegetation of roadsides in Denmark. *Dansk. Bot. Arkiv*, 28, 1-59.

Haq, F. 2011. Conservation status of the critically endangered and endangered species in the Nandiar Khuwar catchment District Battagram, Pakistan. *International Journal of Biodiversity and Conservation*, 3(2): 27–35.

Haugaasen, T. and C. A. Peres. 2007. Floristic, edaphic and structural characteristics of flooded and unflooded forests in the lower Rio Purús region of central Amazonia, Brazil. *Acta Amaz*, 36(1).

Hazrat, Ali, M. Nisar, J. Shah, and S. Ahmad. 2011. Ethnobotanical study of some elite plants belonging to Dir, Kohistan Valley, Khyber Pukhtunkhwa, Pakistan. *Pak. J. Bot.*, 43(2): 787-795.

Heath, M. E., R.F. Barnes and D.S. Metcalfe. 1985. *Forages: The Science of Grassland Agriculture*. Iowa State University, Iowa, Aimes.

Heenan, P. B., A. D. Mitchell, P. A. Mclenachan, P. J. Lockhart and P. J. de Lange. 2007. Natural variation and conservation of *Lepidium sisymbrioides* Hook.f. and *L. solandri* Kirk (Brassicaceae) in South Island, New Zealand, based on morphological and DNA sequence data. *New Zealand Journal of Botany, 45*: 237 – 264.

Heenan, P. B., P. J. De Lange, E. K. Cameron and B. S. Parris. 2008. Checklist of dicotyledons, gymnosperms, and pteridophytes naturalised or casual in New Zealand: additional records 2004–06. *New Zealand Journal of Botany, 46:* 257–283.

Henedy, S. Z. 2002. Palatability and nutritive value of some common plant species from the Aqaba Gulf area of Sinai, Egypt. *Jour. Arid Environments,* 34(1):115-123.

Hernandez-Stefanoni, J, J. Dupuy. 2007. Mapping species density of trees, shrubs and vines in a tropical forest, using field measurements, satellite multiespectral imagery and spatial interpolation. *Biodiversity & Conservation,* 16(13): 3817-3833.

Heydari, M., A. Mahdavi. 2009. Patterns of plant species diversity related to physiographic factors in Melah Gavan protected area, Iran. *Asian J. Biol. Sci.*, 2 (1): 21-28.

Hickman, K. R., D.C. Hartnett, R. C. Cochran and C. E. Owensby. 2004. Grazing management effects on plant species diversity in tallgrass prairie. *J Range Manage*, 57: 58-65.

Hidalgo, L. and M. A. Cauhepe. 1991. Effects of seasonal rest in a above-ground biomass for a native grassland of the Flooding Pampa, Argentina. *Journal of Range Management*, 44, 471-475.

Hill, M. O., H. G. Gouch. 1979. Detrended Correspondence Analysis: an improved ordination technique. Vegetation, 42: 47-58.

Hill, M.O. 1979a. TWINSPAN- A Fortran Program for arranging Multivariate Data in an Ordered Two-Way Table by Classification of the Individuals and Attributes. Cornell Univ. Ithaca. NY.

Hill, M.O. 1979b. DECORANA. A Fortran Program for Detrended Correspondence Analysis and Reciprocal Averaging. Cornell Univ. Ithaca. NY.

Hilton-Taylor, C. 2000. 2000 IUCN Red List of Threatened Species. IUCN, Gland, Switzerland and Cambridge, UK.

Holechek, J. L., R.D. Pieper and C.H. Herba. 1998. *Range Management. Principles and Practices.* 3rd Edition. Prentice Hall, Upper Saddle River, New Jersey, 07458.

Horesfall, M and A.I. Siff. 2005. Effects of metal ion concentration on biosorption of Pb and Cd by *Caladium bicolor. Afri. J. Biotech.*, 4(2): 191-194.

Hossan, S., B. Agarwala, S. Sarwar, M. Karim, R.Jahan and M. Rahmatullah. 2010. Traditional use of medicinal plants in Bangladesh to treat urinary tract infections and sexually transmitted diseases. Ethnobotany, *Research And application.* 8(2010).

Howard, F. D, Macgillivray, J. H and Yamaguchi, M. 1962. Nutrient composition of fresh Californian grown vegetables. Cali. Uni. Agric. Expt. Sta. Bull 788.

http:// en. Wikipedia.org/wiki/leaf_vegetable.

http:// en. Wikipedia.org/wiki/leaf_vegetable.

Hussain, F. and M. J. Durrani. 2009. Seasonal availability, palatability and animal preferences of forage plants in Harboi Arid Range land, Kalat, Pakistan. *Pak. J. Bot.*, 41(2): 539-554.

Hussain, F and M. J. Durrani. 2009. Seasonal availability, palatability and animal preferences of forage plants in Harboi Arid Range land, Kalat, Pakistan. *Pak. J. Bot.*, 41(2): 539-554.

Hussain, K., M. F. Nisar, A. Majeed, K. Nawaz and K. H. Bhatti .2010. Ethnomedicinal Survey for Important Plants of Jalalpur Jattan, District Gujrat, Punjab, Pakistan. *Ethnobotanical Leaflets* 14: 807-25.

Hussain, M. S., A. Sultana, J. A. Khan, A. Khan.2008. Species composition and community structure of forest stands in Kumaon Himalaya, Uttarakhand, India. *Trop. Ecol.* 49(2): 167-181.

Hussain, A., S. N. Mirza, I. A. Khan and M. A. Naeem. 2009. Determination of relative species composition and seasonal plant communities of Nurpur reserved forest in scrub rangelands of District Chakwal. *Pak. J. Agri. Sci.*, 46 (1):34-39.

Hussain, F and S. Taj-Malook. 1984. Biological spectrum and comparison of the coefficient of the communities between plant communities of Karamar Hill, District Mardan. *J. Sci. Tech.*, 8: 53 – 60.

Hussain, F. 1989. *Field and Laboratory Manual of Plant Ecology*. University Grant Commission, Islamabad.

Hussain, F. and H. Sher. 1998. *In situ* protection management and conservation of some economically important medicinal plants of District Swat. *Porc. National Seminar on Medicinal Plants of Pakistan*. PGRI, NARC-IUCN, Islamabad. December 2-3, 1998.

Hussain, F. and I. Ilahi, 1991. *Ecology and Vegetation of Lesser Himalayas,* pp. 96–112. Pakistan. Jadoon Printing Press, Peshawar.

Hussain, F. and L. Badshah. 1998. Vegetation Structure of Pirghar Hills, South Waziristan, Pakistan. *Journal of Tropical and Subtropical Botany.* 6(3): 187- 195.

Hussain, F. and M. Durrani. 2008. Mineral composition of some range grasses and shrubs from Harboi rangeland Kalat, Pakistan. *Pak. J. Bot.*, 40(6): 2513-2523.

Hussain, F. and M. J. Durrani. 2009. Seasonal availability, palatability and animal preferences of forage plants in Harboi arid range land, Kalat, Pakistan. *Pak. J. Bot.*, 41(2): 539-554.

Hussain, F., A. Khaliq and M. J. Durrani. 1995. Ethnobotanical study of some plants of Dabargai hill, district Swat, Pakistan. Pro. First Training Workshop. Ethnobotanical Appl. In Shinwari, Z.K. and (ends) conservation NARC, Islamabad. 206-210.

Hussain, F., A. Murad and Q. Marwat. 1994. Distribution and population of weeds in the maize fields of Mastuj, District Chitral. *Pak. J. Weed Sci. Res.* 7(1-2): 42- 48.

Hussain, F., A. Shah., I. Illahi and A. Rehman, 1992. Phytosociology of the vanishing sub tropical vegetation of Swat with special reference to Docut Hills II: Spring aspect. *Sarhad J. Agri.*, 8: 185–91.

Hussain, F., and M.J. Durrani. 2008. Forage productivity of arid temperate Harboi rangeland, Kalat, Pakistan. *Pak J. Bot.*, 39(5): 1455-1470.

Hussain, F., and M.J. Durrani. 2009b. Nutritional evaluation of some forage plants from Harboi Rangeland, Kalat, Pakistan. *Pak. J. Bot.*, 41(3): 1137-1154.

Hussain, F., Barkatulah, Ibrar, M. 2009. Ethnobotanical studies of plants of Charkotli Hills, Batkhela, district Malakand, Pakistan. *Front. Biol.China.* 4(4): 539-548.

Hussain, F., Iqbal I, Durrani MJ (2006) Ethnobotany of Ghalegay, District Swat, Pakistan. *Acta Botanica Yunnanica,* 28, 305-14.

Hussain, F., L. Badshah and G. Dastagir. 2006. Folk medicinal uses of some plants of South Waziristan, Pakistan. *Pak. J. Pl. Sci.*, 12: 27-40.

Hussain, F., L. Badshah and G. Dastagir. 2006. Folk medicinal uses of some plants of South Waziristan, Pakistan. *Pak. J.Pl. Sci.*, 12(1):27-39.

Hussain, F., L. Badshah and P. Sanaulla. 2004. Ethnobotany of timber wood species of South Waziristan, Pakistan. *Pak. J.Pl. Sci.*, 10(1):9-16.

Hussain, F., m. Ahmad, G. Shaheen and M. J. Durrani. 1994. Phytosociology of the vanishing tropical deciduous forest in district Swabi, Pakistan. ii. Ordination. *Pak. J. Bot.*, 26(1): 149- 160.

Hussain, F., M. Ahmad, M. J. Durrani and G. Shaheen. 1993. Phytosociology of vanishing tropical dry deciduous forests in District Swabi, Pakistan, I. A community analysis. *Pak. J. Bot.*, 25(1): 51- 66.

Hussain, F., M. Ahmed, M.J. Durani and G. Shaheen. 1993. Phytosociology of the vanishing subtropical dry deciduous forests in District Swabi, Pakistan, II. A community analysis. *Pak. J. Bot.*, 25(2): 53-76.

Chapter 5 **References**

Hussain, F., M. Ilyas and S.Takatsuki. 1996. Plant communities of Girbanr Hills, Swat district, northwestern Pakistan. *Ecological Review (Japan)*, 23 (4): 247-260.

Hussain, F., M. Z. Qureshi and S. Shaukat. 1989. Some weed seeds reserves in the cultivated field of Hazaro, District Attock. *Pak. J. Agri. Res.*, 10(3): 273- 280.

Hussain, F., M. Z. Qureshi, and S. Shaukat. 1989. Vegetation of waterlogged and saline areas of Hazro, District Attock. *Pak. J. Agri. Res.*, 10(2): 158- 170.

Hussain, F., S. M. Shah and H. Sher. 2007. Traditional resources evaluation of some plants of Mastuj, District Chitral, Pakistan. *Pak. J. Bot.*, 39: 339-354.

Hussain, F., S. M. Shah and H. Sher. 2007. Traditional resources evaluation of some plants of Mastuj, District Chitral, Pakistan. *Pak. J. Bot.*, 39: 339-354.

Hussain, J., A. Bahader, F. Ullah, N. Rhman, A. L. Khan, W. Ullah and Z. K. Shinwari. 2009. Proximate and Nutrient Analysis of the Locally Manufactured Herbal Medicines and its Raw Material. *Journal of American Science*, Vol. 5(6):1-5.

Hussain, J., A. Bahader, N. Rehman, A.L. Khan, W. Ullah and Z.K. Shinwari. 2010b. Proximate and Nutrient Analysis of the Locally Manufactured Herbal Medicines and Its Raw Material. *J. Amer Sci.*, 6(5): 91-96.

Hussain, J., A.L. Khan, N. Rehman, M. Hamayun, T. Shah, M. Nisar, T. Bano, Z.K. Shinwari and I.J. Lee. 2009c. Proximate and nutrient analysis of selected vegetable species: A case study of Karak Region Pakistan. *African J. Biotechnol.*, 8(12): 2725-2729.

Hussain, J., A.L. Khan, N. Rehman, Zainullah, S.T. Hussain, F. Khan and Z.K. Shinwari. 2009a. Proximate and nutrient analysis of selected medicinal plant species of Pakistan. *Pakistan J. Nut.* 8 (1): 620 -624.

Hussain, J., N. Rehman, A.L. Khan, M. Hamayun, Z.K. Shinwari and I.J. Lee. 2009d. Assessment of herbal drugs and their composite medicinal plants through proximate and micronutrients analysis. *J. Med. Plant Res.*, 3(12): 1072-1077.

Hussain, J., R. Ullah, N. Rehman, A. L. Khan, Z. Muhammad, F. U. Khan, S. T. Hussain and S. Anwar. 2010. Endogenous transitional metal and proximate analysis of

selected medicinal plants from Pakistan. *Journal of Medicinal Plants Research.* 4(3): 267-270.

Hussain, J., Riazullah, N. Rehman, A.L. Khan, Z. Muhammad, Farmanullah and S.T. Hussain. 2010a. Endogenous Transitional Metal and Proximate Analysis of Selected Medicinal Plants from Pakistan. *J. Med. Plant Res.*, 4(3): 267-270.

Hussain, J., Z. Muhammad, R. Ullah, F. Khan, N. Rehman, N. Khan, S. Ahmad, M. Naseem, F. Khan and M. Ismail. 2010. Proximate composition and metal evaluation of four selected medicinal plant species from Pakistan. *Journal of Medicinal Plants Research*, Vol. 4(14):1370-1373.

Hussain, M. I. and A. Perveen. 2009. Plant biodiversity and phytosociological attributes of Tiko Baran (Khirthar Range), *Pak. J. Bot.*, 41(2): 581-586.

Hussain, M., M. Shah, S. Jan, W. Murad, G. M. Shah and N. Bibi. 2006. Vegetational analysis of Machira National Park, Azad Jammu Kashmir (AJK). *Sci. Khy.* 19(1): 79- 87.

Hussain, S. Z., R. N. Malik, M. Javaid and S. Bibi. 2008. Ethonobotanical properties and uses of medicinal plants of Morgah biodiversity Park, Rawalpindi. *Pak. J. Bot.*, 40(5): 1897-1911.

Ibrar, M., F. Hussain and A. Sultan. 2007. Ethnobotanical studies on plant resources of Ranyal hill, District Shangla, Pakistan. *Pak. J. Bot.*, 39(2); 329-337.

Ilyas, M., 1988. An eco taxonomic study of Kirby Koch enclosure. M.Sc. Thesis, Balochistan, Univ., Quetta.

Ipor, I., H. Sani and C. Tawan. 2002. Floristic composition of forest formation at Mahua, Crocker Range National Park, Sabah. *ASEAN Review of Biodiversity and Environmental Conservation*, http://www.arbec.com.my/pdf/art2julysep02.pdf. pp 1- 8.

Iqbal, I. and M. Hamayun. 2003. Studies on the traditional uses of plants of Malam Jabba valley, District Swat, Pakistan. *Journal of ethnobotanical leaflets*, SIUC, USA.

Ishtiaq M. *et al.*, 2006. Ethno veterinary medicinal uses of plants from Samahni valley dist. Bhimber, (AJK). *Asian journal of plant sciences*, 5(2): 390-396.

Islam, M. R., C. K. Saha, N. R. Sharkar, M. Jahilil and M. Hasanuzzamam. 2003. Effect of variety on proportion of botanical fraction and nutritive value of different Napier grass (*Pennisetum puporeum*) and relationship between botanical fraction and nutritive value. *Asian-Australian J. Anim. Sci.*, 16: 177-188.

Islam, MR, C.K. Saha, N.R. Sharker, M. Jahilil and M. Hasanuzzaman. 2003. Effect of variety on proportion of botanical fraction and nutritive value of different Napier grass (*Pennisetum puporeum*) and relationship between botanical fraction and nutritive value. *Asian-Aust. J.Anim. Sci.*, 16: 177-188.

IUCN. 2001. *IUCN Red List Categories and Criteria*: Version 3.1. IUCN Species Survival Commission. IUCN. Gland. Switzerland and Cambridge, UK. 2: 30.

Izco. I. 2008. The role of phytosociological data in floras and taxonomy. *Botanical Journal of the Linnean Society*. 80(2): 179–190.

Jabeen, T. and S.S. Ahmad. 2009. Multivariate analysis of environmental and vegetation

Jackson, M. L. 1967. Soil chemical analysis. Asia Publication House, Bombay. p. 498 .

Jackson, M. L. 1962. *Soil Chemical Analysis*. Constable and Co. Ltd., London. 49p.

Jafari, S. M. and H. Akhani. 2008. Plants of Jahan Nama protected area, Gulestan Province, N. Iran. *Pak. J. Bot.*, 40(4): 1533-1554.

Jain, S. K. 2001. Ethnobotany in modern India. *Phytomorphology* . 51(3-4): 39-54.

James, O. and E. T. Friday. 2010. Proximate and nutrient composition of *Euphorbia hetrophylla*: A medicinal plant from Anyigba, Nigeria. *Journal of Medicinal Plants Research*. 4(14): 1428-1431.

Jesson L. K. 2007. Ecological correlates of diversification in New Zealand angiosperm lineages. *New Zealand J.Botany, 45*: 35-51.

Jongman, R. H. G., C. J. F. Braak, D. F. R. Tongeren. 1995. Data Analysis in Community and Landscape Ecology. Cambridge University Press, Cambridge.

Kababia, D., S. Landan, A. Perevolostsky, Y. Vecht, L. Eliasof and S. Zeltzer. 1992. The feeding behaviour of milking goats in woody rangeland in the Judean Mountains. *Hasssadch*, 72:

Kababia, D., S. Landan, A. Perevolostsky, Y. Vecht, L. Eliasof and S. Zeltzer. 1992. The feeding behaviour of milking goats in woody rangeland in the Judean Mountains. *Hasssadch*, 72: 1536-1540.

Kabata-Pendias, A. and H. Pendias. 1992. *Trace Elements in Soils and Plants*. CRC Press Inc.,Boca Raton, FL.

Kala, C. P.2005. Community composition, species diversity, and secondary succession in grazed and ungrazed alpine meadows of the West Himalaya, India. *Int. J. Fiel. Std.*, 2(1).

Kearns, C. A., D. W. Inouye and N. M. Waser. 1998. The conservation of plant pollinator interactions. *Annual Review of Ecology & Systematics*, 29. 83-112.

Kennenni, L. 2008. Geography and phytosociology of *Acacia tortilis* in the Sudan. *African J. Eco.*, 29(1): 1-10.

Keoghh, J. L. and R. Maples. 1972. Variation in soil test results as affected by seasonal sampling. Bulletin, Arkansas Agricultural Experiment Station. No. 777, p. 26. Arkansas University, Fayetteville, USA, 123: 715-783.

Kershaw, K.A. 1973. Quantitative and Dynamic Plant Ecology. Arnold, London. Plant Ecol., pp. 143-153.

Khalil, I. A. and Rehman, S. 1977. Ber (Zizyphus juyuba mill) as a nutritive fruit. J. Sci. Tech. (Univ. Peshawar). 1:126-128.

Khalil, I. A. and Saleemullah. 2004. Chemistry One. Bio-analytical Chemistry. T. S.Printers, Pakistan: 41.

Khan Z. I., A. Hussain, M. Ashraf, E. E. Valeem and I. Javed. 2005. Evaluation of variation in soil and forage micro-mineral concentrations in a semiarid region of Pakistan. *Pak. J. Bot.*, 37(4): 921-931.

Khan Z. I., A. Hussain, M. Ashraf, E. E. Valeem, M.Y. Ashraf, and M.S. Ahmad. 2004. Soil and forage mineral (Trace Elements) status of a grazing pasture in the semiarid region of Pakistan. *Pak. J. Bot.*, 36(4): 851-856.

Khan Z. I., A. Hussain, M. Ashraf, E. E. Valeem, M.Y. Ashraf, and M.S. Ahmad. 2004. Seasonal variation in soil and forage mineral concentrations in semiarid region of Pakistan. *Pak. J. Bot.*, 36(3): 635-640.

Khan, Z. I., M. Ashraf and E. E. Valeem. 2006. Forage mineral status evaluation: The influence of pasture. *Pak. J. Bot.* 38: 1043-1057

Khan, A.A. 1999. Some common ethnomedicinal uses of plants among the Gond of Chhindwara district, (M.P.) India. *Hamdard Medicus*, 42: 80-83.

Khan, M H. 1978. Phytosociological study in Chitral Gol. *Pak. J. For.* 28(2): 99-110.

Khan, M. I. 2004. Astore Valley, a hub of medicinal plants in Northern Areas of Pakistan: present potential, constraints in conservation & future prospects. WWF-Pakistan, Jutial, Gilgit.

Khan, S. W. 2008. Ethnobotanical studies on some useful herbs of Haramosh and Bugrote valleys in Gilgit, Northern areas of Pakistan. *Pak. J. Bot., 40(1):* 43-58.

Khan, Z. I., M. Ashraf, K. Ahmad, E. E. Valeem and l. R. Mcdowell. 2009. Mineral status of forage and its relationship with that of plasma of farm animals in southern Punjab, Pakistan. *Pak. J. Bot.*, 41(1): 67-72.

Khan, Z. A., M. Ashraf, N.Ahmad, K.Ahmad and E. E. Valeem. 2009. Availability of nutritional minerals (Cobalt, Copper, Iron, Manganese and Zinc) in pastures of Central Punjab for Farm Livestock. *Pak. J. Bot.*, 41(4): 1603-1609.

Khan, Z. I., M. Ashraf and E.E. Valeem. 2006. Forage mineral status evaluation: The influence of pastures. *Pak. J. Bot.*, 38(4): 1043-1054.

Khan, Z. I., M. Ashraf, K. Ahmad, I. Mustafa and M. Danish. 2007. Evaluation of micro minerals composition of different grasses in relation to livestock requirements. *Pak. J. Bot.*, 39(3): 719-728.

Khan, Z. I., M. Ashraf, K. Ahmad, N. Ahmad, M. Danish and E. E.Valeem. 2009. Evaluation of mineral composition of forages for grazing ruminants in Pakistan. *Pak. J. Bot.*, 41(5): 2465-2476.

Kharkwal, G., Y. S. Rawat, Y. S. Pangtey. 2009. An ordination of the forest communities in Nainital catchment of Kumaun Himalaya. *J. Env.Biol.*, Vol., 30 (5): 853-857.

Kharkwal, G. and Y. S. Rawat. 2010. Structure and composition of vegetation in subtropical forests of Kumaun Himalaya. *Afr. J. Plant. Sci.*, Vol., 4(4): 116-121.

Kharkwal, G., P. Mehrotra, Y.S. Rawat and Y. P. S. Pangtey, 2005. Phytodiversity and growth form in relation to altitudinal gradient in the central Himalayan (Kumaun) region of India. *Curr. Sci.*, 89: 873–78.

Kilcher, M. R. 1981. Plant development, stage of maturity and nutrient composition. *J. Range Manage.*, 34: 363-364.

Kiss, T., G. Sipos, K. Bodis, K. Barta. 2004. Community composition, species diversity, and secondary succession in grazed and ungrazed alpine meadows of the west Himalaya, India. *Int. J. Field work Stud.*, 2(1).

Klein, A. S., V. C. Zanette and R. Dos Santos. 2007. Floristic profile and community structure of the herbaceous dune vegetation located in Ilhas, muncipility of Ararangua, Santa Catarina, Brazil. *Biotemas,* 20(3): 15-26.

Knezevic, B., T. Vukovic and B. Raznatovic. 1978. Glasnik Republickog zavoda za zastitu prirode – Prirodnjackog muzeja, 11: 75-78.

Kramberger, B. and S. Klemencic. 2003. Effect of harvest date on the chemical composition and nutrient value of *Ceratium holosteoides*. *Grass & Forage Sci.*, 58: 12-16.

Kramer, K., I. Leinonen and D. Loustau. 2000. The importance of phenology for the evaluation of impact of climate change on growth of boreal, temperate and Mediterranean forests ecosystem: an overview. *Int. J. Biometeorol.*, 44:67-75.

Krishnamurthy, K.V. 2003. Textbook of biodiversity, 2003, 276 pp.

Krupnick, G. A.and W. J. Kress. 2006. Plant conservation. A natural history approach. *Science*, 311(5768). 1715.

Kumar, S., J. C. Sharma, I. P. Sharma. 2002. Water retention characteristics and erodibility indices of some soils under different land uses in northwestern Himalayas. *Ind. J. Soil Cons.*, Vol. 30(1): 29-35.

Lalfakawma, U. K. Sahoo, S. Roy, K. Vanlalhriatpuia, and P. C. Vanlalhluna. 2009. Community composition and tree population structure in undisturbed and disturbed

tropical semi-evergreen forest stands of north-east India. Applied Ecology and Environmental Research 7(4): 303-318.

Lama, Y. C., S. K. Ghimire, and Y. Aumeeruddy-Thomas, 2002. Medicinal plants of Dolpo, Amchis, knowledge and conservation. 100 colour plates, 150pp. WWF-Nepal/People and Plants, Kathmandu.

Langenberger, G., K. Martin and J. Sauerborn. 2006. Vascular plant species inventory of Philippine lowland rain forest and its conservation value. *Biodiversity & Conservation,* 15(5): 1271-1301.

Latif, A. and Z. K. Shinwari. 2004. Sustainable market development for non timber forest products in Pakistan. *J. Ethnobotanical Leaflets.* (http://www.siu.edu/~ebl/).

Latif, A., Z. K. Shinwari and S. Begum. 2003. Potential and market status of mushrooms as non-timber forest products in Pakistan. *Journal of ethnobotanical leaflets*, SIUC, USA.

Lichacar, S., R.M. Love, D.W. Rains and H.M. Laude. 1996. The effect of some California soil on the early growth of *Atriplex polycarpa* (Terr.) Wats. and *Atriplex repanda* Phil. In: *Proc.*

Linkie, M. R. J. Smith and N. L.Williams. 2004. Mapping and predicting deforestation patterns in the lowlands of Sumatra. *Biodiversity & Conservation,* 13(10): 1809-1818.

Lubna H. 2001. Analyzing Institutional Set-up of Forest Management in Pakistan. Munich Personal RePEc Archive (MPRA) Paper No. 7343. Munich, Germany: MPRA.

Lyaruu, H.V. 2010. The influence of soil characteristics on plant species diversify and distribution patterns in Western Serengeti, *Tanzania*,Vol. 5(3): 234-241.

Lykke, A. M. and A. Goudiaby. 2008. Structure, floristic composition, and conservation potentials of a remnant gallery forest at 'Mare du Dragon', Senegal. *Nordic J. Bot.,* 19(5): 561 – 574.

Madsen, J. E. and I. B. Ilgaard. 2008. Floristic composition, structure, and dynamics of an upper montane rain forest in Southern Ecuador. *Nordic J. Bot.*, 14(4): 403-423.

Mahmood, A., M. Ahmad, A. Jabeen, M. Zafar and S. Nadeem. 2003. Pharmacognostic studies of some indigenous medicinal plants of Pakistan. *Journal of ethnobotanical leaflets*, SIUC, USA.

Mali, R. 2010. *Cleome viscosa* (wild mustard): A review on ethnobotany, phytochemistry, and pharmacology. *Pharmaceutical Biology*, 48(1): 105-112.

Malik, N. Z. and Z. H. Malik. 2004. Life form and Index of similarity of communities recorded at Kotli Hills during Monsoon 2000. *Pak. J. life Soc. Sci.*, 2(1): 54-56.

Malik, N. Z. and Z. H. Malik. 2004. Present status of sub–tropical chir pine vegetation of Kotli Hills, Azad Jammu and Kashmir. *J. Res. (Sci)*, 15: 85–90.

Malik, N., Z. M. Arshad and S. N. Mirza. 2007. Phytosociological attributes of different plant communities of Pir Chinasi Hills of Azad Jammu and Kashmir. *Intern. J. Agric. & Biology*,9(4): 569- 574.

Malik, R. N., S. Z. Hussain and I. Nazir. 2010. Heavy metal contamination and accumulation in soil and wild plant species from industrial area of islamabad, Pakistan, *Pak. J. Bot.*, 42(1): 291-301.

Malik, R. N and S. Z. Husain (2006). Classification and ordination of vegetation communities of the Lohibehr reserve forest and its surrounding areas, Rawalpindi. *Pak. J. Bot.*, 38(3): 543-558.

Malik, Z. H., 1986. Phytosociological study on the vegetation of Kotli Hills, Azad Jammu and Kashmir. *M. Phil. Thesis*, University of Peshawar, Peshawar.

Malik, Z. H., 2005. Comparative study on the vegetation of Ganga Chotti and Bedori hills District Bagh, Azad Jammu and Kashmir with special reference to Range conditions. *PhD Thesis*, University of Peshawar.

Malik, Z. H., Hussain, F., 1987. Phytosociological study of vegetation around Muzaffarabad. In: Slahi, I., Hussain, F. (Eds.), Mod. Trends. Pl.Sci. Res., Pakistan, pp. 13–17.

Malik, Z. H.; N. Z. Malik, S. Bashir, M. S. Gorsi, 2001. Phytosociological studies on the vegetation of Dao Khun Hills during monsoon, 2000. *Jour. Science & Technology (Pakistan),* 25(1): 35 – 41.

Manhas, R. K., L. Singh, H. B. Vasistha and M. Negi. 2010. Floristic diversity of protected ecosystems of Kandi Region of Punjab, India. *New York Sci. J.,* 3(4):96-103.

Manhas, R. K., M. K. Gautam and D. Kumari. 2009. Plant Diversity of a Fresh Water Swamp of Doon Valley, India. *Journal of American Sci.,* 5(1), 1-7.

Mark, A. F., P. Michel and M. Dickinson. *2009.* The conservation (protected area) status of New Zealand's indigenous grasslands: an update. *New Zealand Journal of Botany, 47*:53–60.

Martin, J.G. (2004). *Ethnobotany A Methods Manual.* Earthscan London, Sterling, UK.

McCune, B. and M. J. Mefford. 1999. *PC ORD, Multivariate Analysis of Ecological Data, ver.3.05.* MJM Software, Gledeneden Beach.

McDowell, L., J. H. Conrad and G. L. Ellis. 1985. *Mineral deficiencies and imbalances and their diagnosis.* In: Herbivore Nutrition in Subtropics and Tropics, Graighall, South Africa. (Eds.): F.M.C. Gilchrist & R.I. Mackie. The Science Press, Johannesburg, pp. 67-88.

McDowell, L.R. 1985. In: *Nutrition of Grazing Ruminants in Warm Climates.* Academic Press New York, pp-443.

Medeiros, M. M. and J. M. Felfili. 2007. Floristic-structural comparison of the regeneration and adult layers in Cerrado Sensu Stricto in central Brazil. *Cerne,* 13 (3):291-298.

Menhinick, E.F. 1964. A comparison of some species individual's diversity indices applied to sample of field insects. *Ecology,* 45: 859-861.

Miller, R. F., T.J. Svejcar and J.A. Rose, 2000. Impacts of Western Juniper of plant community composition and structure. *J. Range Manage.,* 53: 574–85.

Milosevic, T., N. Milosevic, I. Glisic and Gorica Paunovic. 2009. Leaf nutritional status and macronutrient dynamics in european hazelnut (*Corylus avellana* L.) under western Serbian conditions. *Pak. J. Bot.,* 41(6): 3169-3178.

Minson, D.J. 1990. The chemical composition and nutritive value of tropical grasses. In: *Tropical grasses FAO Plant Production and Protection Series*, (Eds.): P.J. Skerman and F. Riveros. No: 23. FAO Rome.

Mirza, S.N., G. Akbar, A. W. Begum and A. Nizami. 1995. Current ecological features of vegetation and sustainable use of mountain rangelands in Balochistan. Proceedings of the Regional Workshop on Sustainable Agriculture in Dry and Cold Mountain Areas, Islamabad, PARC/ICIMOD Pakistan.p.254-261.

Moradi, G., M. R. M. Mohadjer, G. Z. Amiri, A. Shirvany and N. Zargham. 2010. Life form and geographical distribution of plants in Posthband region, Khonj, Fars Province, Iran. *Journal of Forestry Research*, 21(2): 201−206.

Moretto, A. S. and R. A. Distel. 1997. Competitive interactions between palatable and unpalatable grasses native to temperate semi-arid grassland of Argentina. 130(3):155-161.

Morrison, D. A.and G. J. Gary, S. M. Pengelly, D. G. Ross, B. J. Mullins, C. R. Thomas, T. S. Anderson and T. Anderson. 2006. Effects of fire frequency on plant species composition of sandstone communities in the Sydney region: Inter-fire interval and time-since-fire. *Austral J. Ecology*, 20(2): 239-247.

Mueller, D.B. and H. Ellenberg, 1974. *Aims and Method of vegetation Ecology,* p. 200. John Wiley and Sons, Inc., New York.

Muhammad, A., K. Khalil, K. B. Marwat, A. Z. Khan, I. H. Khalil, Amanullah and S. Arifullah. 2009. Nutritional quality and production of soybean land races and improved varieties as affected by planting dates. *Pak. J. Bot.*, 41(2): 683-689.

Mulberry for Animal Production (Morus1-L); http://www.fao.org/ag/AGA/AGAP/

Mustafa, N.M., R.M.Ali and K. Shaari. 2000. Evaluation of anti-inflammatory activity of some Malaysian plants using the mouse ear oedema assay. *Journal Tropical Forest Products*, 6:106-112.

Mwafongo, E., I. Nordal, Z. Magombo and B. Stedje. 2010. Ethnobotanical study of Hyacinthaceae and non-hyacinthaceous geophytes in selected districts of Malawi. *Ethnobotany Research & Applications,* 8 (2010).

Nabhan, G. P. 1992. Native plant products from the arid Neotropical species: assessing benefits to cultural, environmental and genetic diversity. In Sustainable Harvest and Marketing of Rain Forest Products (eds Plotkin, M. and Famolare, L.), pp. 137-40. Island Press, Washington DC.

Nadaf, M and S. M. Mortazavi. 2011. Investigation flora and lif form of plants in protected region Sarigol, North Khrasan Province, Iran. *Pak. J. Boil. Sci.,* 14(1): 78-81.

Nafeesa Z. Malik, M. Arshad and Sarwat N. Mirza. .2007. Phytosociological Attributes of Different Plant Communities of Pir Chinasi Hills of Azad Jammu and Kashmir. *International Journal of Agriculture & Biology*.pp. 569- 574.

Nai-Bregaglio, M., E. Pucheta and M. Cabido. 20110 El efecto del pastoreo sobre la diversidad floristica y esrtuctural en pastizales de montaña del centro de Argentina. *Rev. Chil. Hist. Nat.,* 23 (2002): 613–623.

Naqinezhad, A., A. Jalili, F. Attar, A. Ghahreman, B. D. Wheeler, J. G. Hodgson, S. C. Shaw and A. Maassoumi. 2009. Floristic characteristics of the wetland sites on dry southern slopes of the Alborz Mts., N. Iran: *Flora,* 204(4): 254-269.

Naqvi, H. H. 1974. Some observation on the vegetation of Peshawar and Khyber Pass area. *Biologia.* 20; 133-143.

Nasir, E. and S. I. Ali. 1972. *An Annotated Flora of West Pakistan.* Stewart Herbarium Gordon College, Rawalpindi and Department of Botany, University of Karachi, Pakistan.

Nasrullah Niimi, M., R. Akashi and O. Kawamura. 2003.Nutritive evaluation of forage plants in South Sulaweshi, Indonesia. *Asian-Aust. J. Anim. Sci.*, 16: 693-701.

Naughton-Treves, L., M. B. Holland and K. Brandon. 2008. The role of protected areas in conserving biodiversity and sustaining local livelihoods. *Annual Review of Environment & Resources*, 30(1). 219 - 252.

Nazir, A and Z. H. Malik. 2006. Life form and index of similarity of plant communities recorded at Sarsawa Hills, district Kotli. *J. Res. BZU. Multan.* 17(1): 27 – 33.

Nebel, G., J. Dragsted and J. K. Vanclay. 2001. Structure and floristic composition of flood plain forests in the Peruvian Amazon: II. The understorey of restinga forests. *Journal of Forest Ecology & Management,* 150 (1): 59-77.

Ngari, E. W. 2010. Ethnomedicne of Ogiek of River Njoro watershed, Nakuru, Kenya. *Ethnobotanical Research and Application.* 8 (2010).

Nisar, M., S. A Tariq and Ihsanullah. 2009. Nutritional levels of *Indigofera gerardiana* Wall and *Crataegus songrica* K. Koch. *Pak. J. Bot.*, 41(3): 1359-1361.

Nyamangara, M. E and L. R. Ndlovu. 1995. Feeding behavior. Feed intake, chemicals and botanical composition of the diet of indigenous goats raised on natural vegetation in a semiarid region of Zimbabwe. *J. Agri. Sci.,* 124: 455-461.

Nyamangara, M.E. and L.R. Ndlovu. 1995. Feeding behaviour, feed intake, chemicals and botanical composition of the diet of indigenous goats raised on natural vegetation in a semiarid region of Zimbabwe. *J. Agri. Sci.,* 124: 455-461.

Oancea, S., N. Foca and A. Airini. 2010. Effect of lead on the growth and photosynthetic activity. *Medicinia Veterinaria.,* 217-220.

Ohlemuller R, S. Walker, J. B. Wilson. 2006. Local vs regional factors as determinants of the invisibility of indigenous forest fragments by alien plant species. *Oikos* 112:493–501.

Oldeland, J., W. Dorigo, L. Lieckfeld, A. Lucieer and N. Jurgens. 2010. Combining vegetation indices, constrained ordination and fuzzy classification for mapping semi-natural vegetation units from hyperspectral imagery. *Remote Sensing of Environment,* 114 (2010): 1155 – 1166.

Olsen, S. R., C. V. Cole, F. S. Watanable and L. A. Dean. 1954. Estimation of available phosphorus in soil in soils by extraction with $NaHCO_3$. U.S.D.A. Cir., 939p.

Omer, R. M., A. J. Hester, I. J. Gordon, M. D. Swaine and S. M. Raffique. 2006. Seasonal changes in pasture biomass, production and off take under transhumance system in Northern Pakistan. *Jour. Arid Environments*, 67: 641-660.

Ozturk, M., I. Uysal, S. Gücel, T. Mert, E. Akcicek and S. Celik. 2008. Ethnoecology of poisonous plants of Turkey and Northern Cyprus. *Pak. J. Bot.*, 40(4): 1359-1386.

Pacala, S. W and M. J. Crawley.1992. Herbivores and plant diversity. *Am. Nat.*, Vol. 140(2):243-60.

Palkova, K. and J. Leps. 2008. Positive relationship between plant palatability and litter decomposition in meadow plants. *Community Ecology*. 9(1): 17-27.

Papachristou, T.G. and A.S. Nastis. 1996. Influence of deciduas broadleaved woody species in goat nutrition during the dry season in Northern Greece. *Small Rumin. Res.*, 20: 15-22.

Papanastasis, V.P., A. Nefzoui and F. Guessous, 2000. Role of woody forage plant and cactus in livestock feeding in arid and semi arid Mediterranian areas. *Proceed. joint ANPA EAAP IHEAM FAD Symposium Agadir Morocoo*, 98: 55–62.

Parizek, B., C. M. Rostagno and R. Sottini. 2002. Soil erosion as affected by shrub encroachment in northeastern Patagonia. *J. Range Manage.*, 55:43-48.

Parizek, B., C. M. Rostagno, and R. Sottini. 2002. Soil erosion as affected by shrub encroachment in northeastern Patagonia. *J. Range Manage*. 55:43-48.

Pausas, J.G and M. P. Austin. 2001. Patterns of species richness in relation to different environments: *An appraisal. J. Veg. Sci.*, 12:153–166.

Peer, T., J. P Gruber, A. Millingard, F. Hussain. 2007. Phytosociology, structure and diversity of the steppes vegetation in the mountains of Northern Pakistan. *Phytocoeno.*, 37: 1-65.

Peinado, M. and J. Aguirre. 2005. A phytosociological survey of the Chionophilous communities of Western North America. Part I: Temperate and Mediterranean Associations. *Vegetatio*, 180(2): 187-241.

Perveen, A. and G. R. Sarwar and I. Hussain. 2008. Plant biodiversity and phytosociological attributes of Dureji (Khirthar Range). *Pak. J. Bot.*, 40(1): 17-24.

Perveen, A. and M.I. Hussain. 2007. Plant biodiversity and phytosociological attributes of Gorakh Hill (Khirthar range) [Pakistan]. *Pak. J. Bot.*, 39(3): 691-698.

Perveen, S. 1998. Nutritive evaluation of some fodder tree leaves through *In vitro* digestibility techniques. Technical Paper, NWFP Agricultural University, Peshawar.

Peter, M., P. J. Edwards, P. Jeanneret, D. Kampmann, A.Lu Scher. 2008. Changes over three decades in the floristic composition of fertile permanent

grasslands in the Swiss Alps. *Agriculture, Ecosystems & Environment,* 125: 204–212.

Pichi-Srmolli, R. E. 1948. An index for stablishing the degree of maturity in plant communities. *J. Ecology.* 36(1): 85-90.

Pielou, E.C. 1975. *Ecological diversity.* Wiley-Interscience New York, p. 165.

Pignatti, S., E. Oberdorfer, J. H. J. Schaminée, V. Westhoff. 2009. On the concept of vegetation class in phytosociology. *Jour. Vegetation Science,* 6 (1):143 – 152.

Pinke, G. and R. Pal. 2009. Floristic composition and conservation value of the stubble-field weed community, dominated by *Stachys annua* in Western Hungary. *Biologia,* 64(2): 279-291.

Pucheta, E., M. Cabido, S. Díaz and G. Funes.1998. Floristic composition, biomass, and aboveground net plant production in grazed and protected sites in mountain grassland of central Argentina. *Acta Oecologica,* 19(2): 97-105.

Puri, G.S., V.M. Meher-Homji, R.K. Gupta & S. Puri. 1983. Phytogeographical ecology. pp. 115-210. In: Forest Ecology. 2nd edn. Oxford & IBH Publishing Company.

Putten, W. H. V. , M. Mace and M. E. Visser. 2010. Predicting species distribution and abundance responses to climate change: why it is essential to include biotic interactions across trophic levels. *Phil. Trans. R. Soc. B.,* 365(1549): 2025-2034.

Qadir, S. A. and O. A. Shetvy, 1986.Life form and leaf size spectra and phytosociology of some Libyan plant communities. *Pak. J. Bot.,* 18(2):271-286.

Qadir, S. A. and S. Ahmad. 1989. Phytosociology of woodland communities of Hazarganji national park, Quetta. *Pak. J. Bot.*, 21(1): 128- 139.

Qadir, S.A. and R.B. Tareen, 1987. Life form and leaf size spectra of the flora of Quetta District. *In*: Ilahi, I and F. Hussain (eds.), *Modern Trends Plant Science and Research Pakistan,* pp: 59–62. Botany Department University of Peshawar.

Qureshi S. A., Z. and M. A. Ahmed. 2004. A phytosociological survey of the Karachi University Campus. *Plant Ecology,* 13 (6): 339 – 362.

Qureshi, R. 2008. Preliminary floristic list of Chotiari Wetland Complex, Nawab Shah, Sindh, Pakistan. *Pak. J. Bot.,* 40(6): 2281-2288.

Qureshi, R. A. , S. A. Gilani and M. A. Ghufran. 2007a. Ethnobotanical studies of plants of Mian wali, District Punjab, Pakistan. *Pak. J. Bot.,* 39(7): 2285-2290.

Qureshi, R. A., M. A. Ghufran, S. A. Gilani, Z. Yousaf, G. Abbas and A. Batool. 2009. Indigenous medicinal plants used by local women in southern Himalayan regions of Pakistan. *Pak. J. Bot.,* 41(1): 19-25.

Qureshi, R. and G. R. Bhatti. 2008. Diversity of microhabitats and their plant resources in Nara desert, Pakistan. *Pak. J. Bot.*, 40(3): 979-992.

Qureshi, R. and G. R. Bhatti. 2010. Floristic inventory of Pai forest, Nawab Shah, Sindh, Pakistan. *Pak. J. Bot.*, 42(4): 2215 – 2224.

Qureshi, R., A. Waheed, M. Arshad and T. Ambreen. 2009. Medico-ethnobotanical inventory of Tehsil Chakwal, Pakistan. *Pak. J. Bot.*, 41: 529-538.

Qureshi, R., A. Waheed, M. Arshad and T. Umbreen. 2009. Medico ethnobotanical inventory of Tehsil Chakwal, Pakistan. *Pak. J. Bot.*, 41(2):529-538.

Qureshi, R., G.R. Bhatti and A.S. Ghanghro. 2001a. Quantitative Analysis of Weed Communities of Tomato (*Lycopersicum esculentum* Mill.) Crop of Kacha Area (River Indus) of District Sukkur, *Hamdard Medicus*, 49(4): 136-141.

Qureshi, S. J. and M. A. Khan. 2001b. Ethnobotanical study of Kahuta from Rawalpindi District, Pakistan. *J. Biol. Sci.,* 1(1): 27-30.

Rahim, I., J. I. Sultan, M. Yaqoob, H. Nawaz, I. Javed and M. Hameed. 2008. Mineral profile, palatability and digestibility of marginal land grasses of Trans-Himalayan Grasslands of Pakistan. *Pak. J. Bot.*, 40(1): 237-248.

Rahim, I., J. I. Sultan, M. Yaqoob, H. Nawaz, I. Javed and M. Hameed. 2008. Mineral profile, palatability and digestibility of marginal land grasses of Trans-Himalayan grasslands of Pakistan. *Pak. J. Bot.*, 40(1): 237-248.

Raina, J. N. 1988. Physico-chemical properties and available macronutrient status of citrus growing soils of Poanta valley in Himachal Pradesh. *Him. J. Agri. Res.*, 2: 71-78.

Ralhan, P. K., A.K. Saxena and J. S. Singh. 1982. Analysis of forest vegetation at and around Naini Tal in Kumaun Himalaya. Proceedings of Indian National Science Academy B 48: 121-137.

Ram J., A. Kumar, J. Bhatt, J. 2004. Plant diversity in six forest types of Uttranchal, Central Himalaya, India. *Curr. Sci.* 86: 975-978.

Ram, J, A. Kumar, J. Bhatt. 2004. Plant diversity in six forest types of Uttranchal, Central Himalaya, India. *Curr. Sci.* 86: 975-978.

Ram, J. and P. Arya. 1991. "Plant forms and vegetation analysis of an alpine meadow of Central Himalaya, India", *Proceedings of Indian National Science Academy*, 57(5), 311 – 317.

Rana, T. S., B. Datt and R. R. Rao. 2002. Life form and bioloigicalspectrum of the flora of Tons Valley, Garhwal Himalaya (Uttarunchal), India. *Taiwania*, 47(2):164-169.

Rasheed, F., S. Hafeez, I. Q. Bhabha. 2005. Phytosociological study and determination of carrying capacity of the reserve forest compartment -17 of Margallah Hills National Park [Pakistan]. *Pak. J. Agricul. Sciences,* 42(1-2): 71-74.

Rashid, A., S. Khan and F. Hussain. 1998. Distribution of some weeds in Tumeric fields of Distric Banuu. *Pak. J. Agric. Res.* 9(4): 556-561.

Rasool, E., A. Rehman and Ihsanullah. 2005. Livestock feed resources: A case study in Asghra- Wazulum Valley, Balochistan. On line Document. http://cnrit.edu/conf/isnh/postonline/

Rasool, E., A. Rehman and I. Ullah. 2005. Livestock feed resources: A case study in Asghara Wazulun valley, Balochistan. Online documents. http:/cnrit/tamu.edu/ conf/isule/post 0110 /6.24.2005.

Ratter, J. A., S. Bridgewater and J. F. Ribeiro. 2003. Analysis of the floristic composition of the Brazilian Cerrado Vegetation iii: comparison of the woody vegetation of 376 areas. *Edinburgh J. Botany*, 60(1):57-109.

Raunkiær, C. (1934) Om biologiske Typer, med Hensyn til Planternes Tilpasninger til at overleve ugunstige Aarstider. Botanisk Tidsskrift 26, p. XIV. Also as Ch. 1: Biological types with reference to the adaption of plants to survive the unfavourable season, in: The Life Forms of Plants and Statistical Plant Geography. Oxford University Press, Oxford; p. 1.

Raunkiaer, C. 1934. Life form of plants and statistical geography. Clarendon Press, Oxford.

Raunkiaer, C. 1934. *The life forms of Plants and Statistical Plant Geography.* Translated by Carter, Fausboll and Tansely; Oxford Univ. Press.

Razaq, A., A. Rashid, Haidar Ali, H. Ahmad and M. Islam. 2010. Ethnomedicinal potential of plants of Changa Valley District Shangla, Pakistan. *Pak. J. Bot.*, 42(5): 3463-3475.

Reddy, C. S., C. Pattanaik, A. Mohapatra and A. K. Biswal. 2007. Phytosociological observations on tree diversity of tropical forest of Similipal Biosphere Reserve, Orissa, India. *Taiwania,* 52(4): 352-359.

Rehman, A. 1995. *The potential for the use of salt bush in sheep grazing systems during summer and autumn in a Mediterranean climate*. Ph.D. Thesis, University of Western Australia.

Rehman, A. and M. Z. Iqbal. 2008. Level of heavy metals in the foliage of naturally Growing plants collected from korangi and landhi Industrial areas of Karachi city, Pakistan. *Pak. J. Bot.*, 40(2): 785-789.

Rehman, S. A. and M. Z. Iqbal. 2008. Level of heavy metals in the foliage of naturally growing plants collected from Korangi and Landhi Industrial areas of Karachi City, Pakistan. *Pak. J. Bot.*, 40(2): 785-789.

Rehman, S. and M. H. Bokhari. 1997. Gymnosperms of Azad Kashmir, Pakistan. *Pak. J. Pl. Sci.,* 3(2): 53- 63.

Robles, C. A. B. and L. J. Boza. 1993. Native forage flora of south-eastern Spain. II. Nutritive value. *Pastos,* 29: 47-60.

Rout, S.D., T. Panda and N. Mishra. 2009. Ethno-medicinal plants used to cure different diseases by Tribals of Mayurbhanj District of North Orissa. *Ethno-Med.*, 3(1): 27-32.

Saha, S.C. and B.N. Gupta. 1987. Tree leaves as feed for dairy cattle in India. *India Dairyman*, 39:489-492.

Said, H. M., A. Saeed, L. A. D,Silva, H. N. Zubairy and Z. Bano. 1996. Medicinal herbal a text book of for medical studnts and doctors. Hamdard Foundation Pakistan, Nazimabad, Karachi, Pakistan.

Saidu, A. N. and N. G. Jidobi. 2009. The Proximate and Elemental Analysis of some Leafy Vegetables Grown in Minna and Environs. *J. Appl. Sci. Environ. Manage.* 13(4) 21 – 22.

Sakya, S.R. and A.M.S. Bania, 1998. Natural vegetation of Chandragiri region. *Ecoprint,* 5: 51–55.

Salgado, Cristiano S., and Steven C. Pennings. 2005. Latitudinal variation in palatability of salt-marsh plants: are differences constitutive? *Ecology,* 86:1571-1579.

Sardar, A. A. and Z. U. Khan. 2009. Ethnomedicinal studies on plant resources of Tehsil Shakargarh, District Narowal, Pakistan. *Pak. J. Bot.*, 41(1): 11-18.

Sarmiento, G., M. Pinillos, M. P. Silva da, D. Acevedo. 2004. Effects of soil water regime and grazing on vegetation diversity and production in a hyper seasonal savanna in the Apure Llanos, Venezuela. *J. Trop. Ecol.*, 20: 209-220.

Sarwar, G. H., Schmeisky, N. Hussain, S. M. Tahir, M.A. and U. Saleem. 2009. Variations in nutrient concentrations of wheat and paddy as affected by different levels of Compost and chemical fertilizer in normal soil, *Pak. J. Bot.*, 41(5): 2403-2410.

Sasaki, T., T. Okayasu, K. Takeuchi, U. Jamsran and S. Jadambaa. 2005. Patterns of floristic composition under different grazing intensities in Bulgan, South Gobi, Mongolia. *J. Grassland Sci.*, 51(3): 235-242.

Sati, V.P. 2005. Natural Resource Conditions and Economic Development in the Uttranchal Himalaya,India. J. Mt. Sci. 2(4): 336-350.

Saxena, A. K., P. Pandey and J. S. Singh. 2004. Biological spectrum and other structural functional attributes of the vegetation of Kumaun Himalaya. *Plant ecology,* 49(2): 111-119.

Saxena, A.K. & J.S. Singh. 1982. A phytosoiological analysis of woody plant species in forest communities of a part of Kumaun Himalaya. Vegetatio 50: 3-22.

Saxena, A.K., S.P. Singh & J. S. Singh. 1985a. Populationb structure of forests of Kumaun Himalaya. implication for management. Journal of Environmental Management 19: 307-324.

Saxena, A.K., T. Pandey & J.S. Singh. 1985b. Altitudinal variation in the vegetation of Kumaon Himalayas. pp. 43-66. In: D.N. Rao. K.J. Ahmed. M. Yunus & S.N. Singh (eds.) Perspectives in Environmental Botany. Print House, Lucknow.

Schmidt, D.T., 1971. Comparative Yield and Composition of Eight Tropical Leafy Vegetables at Two Different Fertility Levels. Agro. J., 63:67-80.

Schultes, R. E. and S. Von Reis. 1995. Ethnobotany: evolution of a discipline. Chapman and Hall, London.

Sebastia, M. T. 2004. Role of topography and soils in grassland structuring at the landscape and community scales, *Basic Appl. Ecol.*, Vol., 5: 331–346.

Semmar, N., M. Jay, M. Farman and R. Monfond 2005. Chemotaxonomic analysis of *Astragalus caprinus* (Fabaceae) based on the flavonic patterns. *Biochemical Systematic and ecology*, 33:187-2000.

Senger, M. R., J. S. Kelly, G. C. Ghisleni, R. D. Dias & M. R. Bogo and C. D. Bonan. 2010. Aluminum exposure alters behavioral parameters and increases acetylcholinesterase activity in zebrafish (Danio rerio) brain. *Cell Biol Toxicol.* 27:199–205.

Sepah, M. P. and S. M. Chughtai. 2004. Foold plains vegetation of Kabul river in Duaba Daudzai area near Peshawar, temporary lagoon and bottom beds. Sci. Khy., 17(1) 21- 44.

Serra, A.B., S.D. Serra, E.A. Orden, L.C. Cruz, K. Nakamura and T. Fujihara. 1997. Variability in ash, crude protein, detergent fibre, and mineral content of some minor plant species collected from pastures grazed by goats. *Asian-Aust J. Anim. Sci.*, 10: 28-34.

Shabbir, M. K., R. Nadeem, H. Mukhtar, F. Anwar and M. W. Mumtaz. 2009. Physico-chemical analysis and determination of various chemical constituents of essential oil in *Rosa centifolia*. *Pak. J. Bot.*, 41(2): 615-620.

Shad, M., H. Nawaz, M. Hussain and B. Yousaf. 2011. Proximate composition and functional properties of rhizomes of lotus (*Nelumbo nucifera*) From Punjab, Pakistan. *Pak. J. Bot.*, 43(2): 895-904.

Shah, S. M., W. Mohammed and M. M. Iqbal. 1986. Micro-nutrient status of the soils of the Frontier Regions. *Pak. J. Sci. Ind. Res.*, 29(4): 288-90.

Shah, S. R. U., G. Hussan, A. Rehman and I. Ahmed. 2006. Ethnobotanical studies of flora of District Musakhel and Barkhan in Balochistan, Pakistan. *Pak. J. Weed Sci. Res.*, 12: 199-211.

Shaheen, H., R.A. Qureshi, Zahidullah and T. Ahmad. 2011. Anthropogenic pressure on the western Himalayan moist temperate forests of Bagh, Azad Jammu & Kashmir. *Pak. J. Bot.*, 43 (1): 695-703.

Shakya J, D., G. P. Joshi., and B. Aryal. 2000. Floristic composition of Butwal area and its surrounding hills. *Banko Janakari*, 10(1): 42-46.

Shaltout, K., H. M. G. Sheded, H. F. El-Kady and Y. M. Al-Sodany. 2002. Phytosociology and size structure of *Nitraria retusa* along the Egyptian Red Sea coast. *J. Arid. Environ.*, 53 (3): 331-345.

Shameem, S. A., N. Irfana and G. A. Bhat. 2011. Comparative assessment of edaphic features and herbaceous diversity in lower Dachigam national park, Kashmir, Himalaya. *J. Eco. N. Environ.*, 3(6): 196-204.

Shannon, C.E and Weiner, W. 1963. The Mathematical Theory of Communication. University Illinois Press, Urbana.

Sharma, C. M., S. K. Ghildiyal, S. Gairola, S. Suyal. 2009. Vegetation structure, composition and diversity in relation to the soil characteristics of temperate mixed broad-leaved forest along an altitudinal gradient in Garhwal Himalaya. *Ind. J. Sci. Technol.*, 2(7): 39-45.

Sharma, K. P and B. P. Upadhyaya. 2002. Phytosociology, primary production and nutrient retention in herbaceous vegetation of the forestry arboretum on the Aravalli hills at Jaipur. *Tropical Ecology*, 43(2): 325-335.

Sheikh, Z., N. A. Bangash and S. H. R. Rizvi, 1974. Irrigated soils of Balochistan, *Agr. Pakistan*, XXV. 185-207.

Sher, H., M. N. Al-yemeni and L. Wijaya. 2011. Ethnobotanical and antibacterial potential of *Salvadora persica* l: A well known medicinal plant in Arab and Unani system of medicine. *J. M. P. R.*, 5(7): 1224-1229.

Sher, H. and M. N. Al-Yemeni. 2011. Ecological investigation of the weed flora in arable and non arable land of Al-kharj, Saudi Arabia. *Afr. J. Agric. Res.*, 6(4): 901-906.

Sher, H. and F. Hussain. 2009. Ethnobotanical evaluation of some plant resources in Northern part of Pakistan. *Afri. J. Biotech.*, 8(17): 4066 -4076.

Sher, H. and Z. D. Khan. 2006. Resource utilization for economic development and folk medicine among the tribal people observation from northern part of Pakistan. *Pak. J. Pl. Sci.*, 12(2): 149-162.

Sher, H., F. Hussain and A. Sher. 2010. *Ex-situ* management study of some high value medicinal plant species in Swat, Pakistan. *Ethnobotany Research & Applications*, 8 (2010).

Sher, H., Midrarullah, A.U. Khan, F. Hussain and S. Ahmad. 2003. Medicinal plants of Udigram, District Swat, Pakistan. *Pak. J. Forest.*, 53(1): 65-74.

Sher, H., Z. D. Khan, A. U. Khan, and F. Hussain. 2004. Ethnobotanical studies on some plants of village Tigdari, District Swat, Pakistan. *Act Bot. Yunnanica*, 15: 42-54.

Sher, Z. and Z. Khan. 2007. Floristic composition, life form and leaf spectra of the vegetation of Chagharzai Valley, District Buner. *Pak. J. Pl. Sci.*, 13 (1): 57-66.

Shinwari, Z. K. and I. K.Wazir. 1988. A key and checklist to the weeds of wheat fields of Bannu District. *Pak. J. Agric. Res.*, 9(4): 561- 568.

Shinwari, Z. K. and M. Shah. 1996. The ethnobotany of Kharan District, Balochistan. In Shinwari, Z. K., B. A. Khan and A. A. Khan (ed.). Proceedings Ethnobotany and its Application to Conservation Sep. 1996. Pp. 124-132.

Shinwari, Z. K. and M. Shah. 1996. The ethnobotany of Kharan District, Balochistan, Proceeding first Training Workshop *Ethno. Appl. Conserv.* 124-132. HARC, Islamabad.

Shinwari, Z. K., A. A. Khan and T. Nakaike. 2003. Medicinal and other useful plants of District Swat, WWF. Pakistan. pp. 110-127.

Shinwari, Z. K., S. S. Gilani, Khan, A. A. 2002. "Wise-practices and experiential learning in the conservation and management of Himalayan medicinal plants" In the regional workshop held at Kathmandu, Nepal from 15 – 20th December 2002.

Shinwari. Z. K. A. S. Khan and T. Nakaike. 2003. Medicinal and other important plants of District Swat. Ethnobotany Project WWF-P, Peshawar.

Shrestha, R. & Wegge, P. 2008. Wild sheep and livestock in Nepal Trans-Himalaya: coexistence or competition? Environmental Conservation 35: 125–136.

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

Siddiqui, T.O., K. Javed and M.M. Aslam.2000. Folk medicinal claims of western Uttar Pradesh, India. *Hamdard Medicus*, 43: 59-60.

Sing, V. and R. P. Pandhey. 1998. Ethnobotany of Rajistan, India. In Ethnobotany of Rajistan, India., Pawan Kumat Scientific publishers., Jodhpur India. Pp. 367.

Singh, J. S and Singh, S. P. 1992. Forest of Himalaya, Structure, Functioning and impact of Man. Gyanodaya Prakashan, Naintal, India.

Singh, J. S. 2006. Sustainable development of the Indian Himalayan region: Linking ecological and economic concerns. *Curr. Sci.* 90(6): 784-788.

Singh, J. S., Singh, S. P. 1992. Forest of Himalaya, Structure, Functioning and impact of Man. Gyanodaya Prakashan, Nainital, India.

Singh, J. S., Y.S. Rawat & S.P. Chaturvedi. 1984. Replacement of Oak forest with Pine in the Himalaya affects the nitrogen cycle. Nature 311: 54-56.

Singh, J.S. & S.P. Singh. 1987. Structure and functioning of central Himalayan chirpine forest ecosystem. Current Science 56: 383-391.

Singh, R. S., P. K. Rahlan & S. P. Singh. 1997. Phytosociological and population structure of mixed Oak conifer forest in a part of Kumaun Himalaya. Environmental Ecology 5: 475-487.

Singh, S. P., P. Sah, V. Tyagi and B.S. Jina, 2005. Species diversity contributes to productivity. Evidence from natural grassland communities of the Himalaya. *Curr. Sci.*, 89: 548–52.

Singh. 1984. An Integrated Ecological Study of Eastern Kumaun Himalaya with Emphasis on Natural Resources. Vol. 1-3, Final Report (HCS/DST/187/76). Kumaun University, Naini Tal.

Skerman, P.J and F. Riveros. 1990. *Tropical grasses*. FAO Plant Production and Protection Series, No. 23. FAO Rome.

Sorensen, T. 1948. A method of establishing groups of equal amplitude in plant sociology based on similarity of species content. Detkong Dansk Vidensk. *Selsk. Biol. Skr.*, 5: 1-34.

Spano, D., C. Cesaraccio, P. Duce, R. L. Snyder. 1999. Phenological stages of natural species and their use as climate indicators. *Int. J. Biometeorol*, 42, 124–133.

Sparks , T.H., E. P. Jeffree, C. E. Jeffree, 2000. An examination of relationship between flowering times and temperature at the national scale using long-term phonological record from the UK. *Int J Biometeorol*, 44, 82-87.

Steege, H. T., D. Sabatier, H. Castellanos, T. Van andel, J. Duivenvoorden , A. Adalardo de Oliveira, R. Ek, R. Lilwah, P. Maas and S. Mori. 2000. An analysis of the floristic composition and diversity of Amazonian forests including those of the Guiana shield. *J. Tropical Ecology,* 16(6):801-828.

Stefanoni, J. H. and J. Dupuy. 2007. Mapping species density of trees, shrubs and vines in a tropical forest, using field measurements, satellite multiespectral imagery and spatial interpolation. *Biodiversity and Conservation,* 16(13):3817-3833.

Stewart, R. R. 1982. History and exploration of plants in Pakistan and adjoining Areas (Nasir, E. and S.I. Ali, eds.) Pan Graphics, Islamabad, Pakistan.

Sultan, J. I., I. Rahim, H. Nawaz, M. Yaqoob and I. Javed. 2009. Nutritional evaluation of fodder tree leaves of northern grasslands of Pakistan. *Pak. J. Bot.*, 40(6): 2503-2512.

Sultan, J. I., I. Rahim, M.Yaqoob, M.I. Mustafa, H. Nawaz1 and P. Akhtar. 2009. Nutritional evaluation of herbs as fodder source for ruminants. *Pak. J. Bot.*, 41(6): 2765-2776.

Sultan, J. I., Inam-ur-Rahim, H. Nawaz and M. Yaqoob. 2007. Nutritive value of marginal grasses of northern grasslands of Pakistan. *Pak. J. Bot.*, 39: 1071-1082.

Sultan, J. I., Inam-ur-Rahim, H. Nawaz, M. Yaqoob and H. Hameed. 2008. Nutritive value of free rangeland grasses of northern grasslands of Pakistan. *Pak. J. Bot.*, 40: 249-258.

Tareen, R. B and S. A. Qadir. 1987. Phytosociology of the plains of Quetta district. Pak. J. Bot., 19: 139 – 156.

Tareen, R. B and S. A. Qadir. 1990. Phytosociology of the water courses of Quetta district. Pak. J. Bot., 122: 52 – 65.

Tareen, R. B and S. A. Qadir. 1991. Phytosociology of the hills of Quetta district. Pak. J. Bot., 23: 90 – 114.

Tareen, R. B. 1986. An ecotaxonomic study of Quetta District. M. Phil thesis. Baluchistan University. Quetta.

Tareen, R. B. and S. A Qadir. 1993. Life form and leaf size spectra of the plant communities of diverse areas ranging from Harnai, Sinjawi to Duki regions of Pakistan. *Pak. J. Bot.*, 25(1): 83-92.

Tareen, R. B. and S. A. Qadir. 2000. Phytosociology of the plains of diverse areas ranging from Harnai, Sinjawi to Duki Regions of Pakistan. *Pak. J. Biol. Sci.*, 3 (12): 2135-2144.

Telascrea, M., C. C. Araujo, M. O. M. Marques, R. Facanali, P.L.R. Moraes and A.J. Cavalheiro, 2007. Essential oil from leaves of *Cryptocarya mandioccana* Meisner (Lauraceae): Composition and intraspecific chemical variability. *Biochem. Syst. Ecol.*, 35: 222–232

Terzioolu, S., R. Anin, M. Kylynç and C. Acar. 2007. Vascular plant diversity in Solakly watershed in Northeastern Turkey. *Phytologia Balcanica,* 13 (2):213 –222.

Tetali, P., C. Waghchaure, P. G. Daswani, N. H. Antia and T. J. Birdi. 2009. Ethnobotanical survey of antidirrhoeal plants of Parinche valley, Pune District, Maharashtra, India. *Journal of Ethnopharmacology,* 123(2009): 229 – 236.

Toledo, G. M., (1996). Ethnobotanical study of the Chiquitanos from Lomerio, Santa Cruz, Bolvia. *Ecologia –En Bolivia*, No. 27: 31-42.

Toledo, M. and J. Basin. 2005. Secondary succession and indigenous management in semi deciduous forest fallow of the Amazon Basin. *Biotropica,* 38(2): 161-170.

Turner, W. R., T. Nakamura, M. Dinetti. 2004. Global urbanization and separation of humans from nature. *Bio. Sci.,* Vol., 54: 585-590.

Vallentine, J. F. 2001. Grazing Management. Academic Press, San Diego/San Francisco/New York/Boston/London/Sydney/Tokyo.

Verma R. K, K. S. Kapoor, R. S. Rawat, S. P. Subramani, S. Kumar. 2005. Analysis of plant diversity in degraded and plantation forests in Kunihar forest division of Himachal Pradesh. *Ind. J. For.*, 28(1): 11-16.

Verma, R., G. P. Satsangi and J. N. Shrivastava. 2010. Ethno-medicinal profile of different plant parts of *Calotropis procera* (Ait.) R. Br. *Ethnobotanical Leaflets,* 14: 721-42.

Vetrichelvan, T. and M. Jegadeesan. 2001. Ethnobotanical study of Tiruchirapalli District, Tamil Nadu, India. Part I. Diuretic and anti- inflammatory medicinal plants. *Hamdard Medicus,* 64 (4): 125-128.

Visser, M. E and C. Both. 2005. Shifts in phenology due to global climate change: the need for a yardstick. *Animal Ecology,* 272 (1581): 2561-2569.

Wahid, A. 1990. *Dietary composition and nutritional status of sheep and goats grazing in tworangeland types in Balochistan, Pakistan.* Ph. D. Thesis, Oregon State University.

Wahid, A. 1990. Dietary composition and nutritional status of sheep and goats grazing two rangeland types in Balochistan, Pakistan. Ph. D. Thesis, Oregon State University.

Warming, E. (1908) Om planterigets Livsformer [translated title: On the life forms in the vegetable kingdom]. G.E.C. Gad, Kobenhavn.

Wazir. S. M., S. Saima., A. A. Dasti and M. Subhan. 2007. Ethnobotanical importance of Salt Range species of District Karak, Pakistan. *Pak. J. Pl. Sci.*, 13: 27-29.

Wergerand, M. J. A and G. A. Ellenbroek. 2004. Leaf size and leaf consistence of a riverine forest formation along a climatic gradient. *Oecologia,* .34 (3): 297-308.

Whittaker, R.H. 1956. Vegetation of the great smoky mountains. *Ecol. Mongor.*,26: 1-80.

Winter, S., G. Chirici, R. E. Mcroberts, E. Hauk and E. Tomppo. 2008. Possibilities for harmonizing national forest inventory data for use in forest biodiversity assessments. *Forestry,* 81(1).

Wu, R. and Tiessen, H. 2002. Effect of land use on soil degradation in alpine grassland soil, China. *Soil. Sci. Soc. Am. J.*, 66:1648-1655.

Yadav, A.S and S.K. Gupta. 2007. Effect of micro-environment and human disturbance on the diversity of herbaceous species in Sariska Tiger Project.*Tropical Ecology,* 48(1): 125-128.

Yao, J., B. Yan, X.Q. Wang and J.X. Liu. 2000. Nutritional evaluation of mulberry leaves tas feeds for ruminants. *Livest. Res. Rural Develop.*, 12: 9-16.

Zabihullah,Q., A. Rashid and N. Akhtar. 2006. Ethnobotanical survey in Kot Manzaray Baba Valley Malakand Agency, Pakistan. *Pak. J. Pl. Sci.*, 12 (2): 115-121.

Zafar, M., M. A. Khan, M. Ahmad, G. Jan, S. Sultana, K. Ullah, S. K. Marwat, F. Ahmad, A. Jabeen, A. Nazir, A. M. Abbasi, Z. Rhman and Z. Ullah. 2010. Elemental analysis of some medicinal plants used in traditional medicine by atomic absorption spectrophotometer (AAS). *J. M. P. R.*, 4(19): 1987-1990.

Zhou H., Y. Tang, X. Zhao and L. Zhou. 2006. Long-term grazing alters species composition and biomass of a shrub meadow on the Qinghai -Tibet Plateau. *Pak. J. Bot.*, 38(4): 1055-1069.

Zielinska, E. and J. Solon. 1997. Effect of geographical location on species composition, Vegetation structure, diversity and phytoindicative characteristics in pine forests. *Environmental Pollution.*, 98 (3):347-360.

Table 1.1.1. Phytosociological attributes of Oona, Site One, Spring Season Chakesar Valley, Shangla.

				Community Attributes							
	Herbaceous layer	No	%	D	RD	F	RF	RCC	IV	NSP	C.C
Species											
1	*Artemisia vulgare* L.	34	6.5	3.4	6.5	50.0	19.2	4.9	30.7	5	50
2	*Conyza aegyptica* L.	5	1.0	0.5	1.0	20.0	7.7	1.0	9.6	2	20
3	*Euphorbia granulata* L.	3	0.6	0.3	0.6	10.0	3.8	0.5	4.9	1	10
4	*Dichanthium annulatum* (Forssk.) Stapf	353	67.6	35.3	67.6	90.0	34.6	67.8	170.0	9	90
5	*Verbena officinalis* Linn.	5	1.0	0.5	1.0	10.0	3.8	0.5	5.3	1	10
6	*Brachiaria reptens* (L.) Stapf.	10	1.9	1.0	1.9	10.0	3.8	3.0	8.7	1	10
7	*Verbascum thapsis* L.	5	1.0	0.5	1.0	30.0	11.5	1.2	13.7	3	30
8	*Sorghum nephalensis* (L.) Hill.	70	13.4	7.0	13.4	10.0	3.8	12.3	29.6	1	10
9	*Scirpus spp.*	37	7.1	3.7	7.1	30.0	11.5	8.9	27.5	3	30
Shrubby layer											
1	*Berberis lycium* Royle.	127	58.8	12.7	58.8	80.0	66.7	64.4	189.9	8	80
2	*Segeretia thea* (Osbeck) M. C. Johnst.	88	40.7	8.8	40.7	30.0	25.0	35.0	100.7	3	30
3	*Rubus fruiticosus* L.	1	0.5	0.1	0.5	10.0	8.3	1.0	9.8	1	10
Tree layer											
1	*Ficus palmata* Forssk.	4	12.9	0.4	12.9	20.0	12.5	8.1	33.5	2	20
2	*Melia azadarichta* L.	5	16.1	0.5	16.1	20.0	12.5	3.1	31.8	2	20
3	*Ailanthus altissima* (Miller) Swingle	4	12.9	0.4	12.9	20.0	12.5	6.7	32.1	2	20
4	*Morus alba* L.	1	3.2	0.1	3.2	10.0	6.3	20.9	30.4	1	10
5	*Pinus wallichiana* A. B. Jackson.	4	12.9	0.4	12.9	20.0	12.5	10.9	36.3	2	20

6	*Quercus incana* Roxb.	10	32.3	1.0	32.3	40.0	25.0	26.8	84.1	4	40
7	*Morus nigra* L.	2	6.5	0.2	6.5	20.0	12.5	10.9	29.8	2	20
8	*Olea ferruginea* Royle	1	3.2	0.1	3.2	10.0	6.3	12.6	22.1	1	10

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value, NSP= No of stands present and C.C= Constancy Class.

Table 1. 1. 2. Phytosociological attributes of Oona, Site Two, Spring Season Chakesar Valley, Shangla.

				Community Attributes							
No	**Species**	No	%	D	RD	F	RF	RCC	IV	NSP	C.C
1	*Desmostachya bipinnata* (Linn.) Stapf.	30	9.3	3.0	9.3	20.0	10.0	7.2	26.5	2	20
2	*Sorghum nephalensis* (Linn.) Hill.	122	37.8	12.2	37.8	70.0	35.0	57.6	130.4	7	70
3	*Cannabis sativa* Linn.	110	34.1	11.0	34.1	20.0	10.0	29.8	73.8	2	20
4	*Pteris vitata* L.	7	2.2	0.7	2.2	20.0	10.0	1.2	13.4	2	20
5	*Oxalis corniculata* Linn.	11	3.4	1.1	3.4	20.0	10.0	1.2	14.6	2	20
6	*Trifolium repens* Linn.	43	13.3	4.3	13.3	50.0	25.0	3.0	41.3	5	50
Shrubby Layer											
1	*Plectranthus rugosus* Wall.ex Benth.	287	40.0	28.7	40.0	70.0	38.9	38.8	117.7	7	70
2	*Sarcococa saligna* (D. Don) Muell.	340	47.4	34.0	47.4	60.0	33.3	49.5	130.2	6	60
3	*Daphne oleoides* Schreb.	30	4.2	3.0	4.2	10.0	5.6	8.3	18.0	1	10
4	*Zanthoxylum armatum* DC.	20	2.8	2.0	2.8	30.0	16.7	2.7	22.1	3	30
5	*Rubus ellipticus* Smith	40	5.6	4.0	5.6	10.0	5.6	2.0	13.1	1	10
Tree Layer											
1	*Pinus wallichiana*A. B. Jackson.	4	100.0	0.4	100.0	30.0	100.0	100.0	300.0	3	30

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value, NSP= No of stands present and C.C= Constancy Class.

Table 1. 1. 3. Phytosociological attributes of Oona, Site Three, Spring Season Chakesar Valley, Shangla.

				Community Attributes							
No	Species Names	No	%	D	RD	F	RF	RCC	IV	NSP	C.C
1	*Artemisia dubia* Wall.	35	14.5	3.5	14.5	70.0	20.6	7.6	42.7	7	70
2	*Calendula arvensis* Linn.	12	5.0	1.2	5.0	30.0	8.8	1.9	15.7	3	30
3	*Saccharum munja* Roxb.	39	16.2	3.9	16.2	50.0	14.7	23.8	54.7	5	50
4	*Desmostachya bipinnata* (Linn.) Stapf.	70	29.0	7.0	29.0	70.0	20.6	25.8	75.5	7	70
5	*Sorghum nephalensis* (Linn.) Hill.	36	14.9	3.6	14.9	70.0	20.6	13.9	49.5	7	70
6	*Aristida depressa* Retz., Ohs.	38	15.8	3.8	15.8	30.0	8.8	22.5	47.1	3	30
7	*Bromus tectorum* L.	11	4.6	1.1	4.6	20.0	5.9	4.4	14.9	2	20
Shruby Layer											
1	*Berberis lycium* Royle	40	30.8	4.0	30.8	70.0	41.2	22.9	94.8	7	70
2	*Plectranthus rugosus* Wall.ex Benth.	78	60.0	7.8	60.0	80.0	47.1	63.0	170.1	8	80
3	*Sarcococa saligna* (D. Don) Muell.	12	9.2	1.2	9.2	20.0	11.8	14.9	35.9	2	20
Tree Layer											
1	*Quercus dilatata* Lindl.	39	65.0	3.9	65.0	100.0	58.8	37.3	161.1	10	100
2	*Pinus wallichiana* A. B. Jackson.	21	35.0	2.1	35.0	70.0	41.2	62.7	138.9	7	70

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value, NSP= No of stands present and C.C= Constancy Class.

Table 1. 1. 4. Phytosociological attributes of Oona, Site Four, Spring Season Chakesar Valley, Shangla.

			Community Attributes							
No	Species Name	%	D	RD	F	RF	RCC	IV	NSP	C.C
1	*Salvia moorcroftiana* Wall.	2.4	0.6	2.4	50.0	17.9	3.3	23.5	5	50
2	*Cynodon dactylon* (L.) Pers.	38.6	9.7	38.6	80.0	28.6	34.4	101.6	8	80
3	*Conyza bonnariensis* (Linn.) Cronquist.	4.4	1.1	4.4	40.0	14.3	2.7	21.3	4	40
4	*Cannabis sativa* Linn.	52.6	13.2	52.6	70.0	25.0	57.0	134.6	7	70
5	*Xanthium strumarium* Linn.	2.0	0.5	2.0	40.0	14.3	2.7	18.9	4	40
Shrubby Layer										
1	*Plectranthus rugosus* Wall.ex Benth.	41.8	14.2	41.8	90.0	33.3	35.2	110.3	9	90
2	*Indigofera hetrantha* Wall.	43.8	14.9	43.8	100.0	37.0	49.5	130.4	10	100
3	*Berberis lycium* Royle	10.0	3.4	10.0	40.0	14.8	8.9	33.7	4	40
4	*Rumex hastatus* D. Don.	4.4	1.5	4.4	40.0	14.8	2.0	21.2	4	40
Tree Layer										
1	*Ailanthus altissima* (Miller) Swingle.	64.7	1.1	64.7	40.0	44.4	58.4	167.6	4	40
2	*Ficus palmata* Forssk.	35.3	0.6	35.3	50.0	55.6	41.6	132.4	5	50

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value, NSP= No of stands present and C.C= Constancy Class.

Table 1. 1. 5. Phytosociological attributes of Oona, Site Five, Spring Season Chakesar Valley, Shangla.

				Community Attributes							
	Herbaceous layer	No	%	D	RD	F	RF	RCC	IV	NSP	C.C
1	*Mazus reptens* L.	7	2.6	0.7	2.6	30.0	7.3	1.7	11.6	3	30
2	*Salvia moorcroftiana* Wall.	6	2.2	0.6	2.2	50.0	12.2	2.8	17.2	5	50
3	*Polygonatum multiflorum* (L.) A. H.	4	1.5	0.4	1.5	30.0	7.3	1.7	10.5	3	30
4	*Adiantum incisum* Forssk.	7	2.6	0.7	2.6	30.0	7.3	1.7	11.6	3	30
5	*Cynodon dactylon* (L.) Pers.	97	35.5	9.7	35.5	80.0	19.5	29.2	84.2	8	80
6	*Conyza bonnariensis* (Linn.) Cronquist.	11	4.0	1.1	4.0	40.0	9.8	5.1	18.9	4	40
7	*Paeonia emodi* Wall. Ex Hkf.	2	0.7	0.2	0.7	20.0	4.9	1.1	6.7	2	20
8	*Cannabis sativa* Linn.	132	48.4	13.2	48.4	70.0	17.1	53.4	118.8	7	70
9	*Arisaema utile* Hook. F. ex Schott.	2	0.7	0.2	0.7	20.0	4.9	1.1	6.7	2	20
10	*Xanthium strumarium* Linn.	5	1.8	0.5	1.8	40.0	9.8	2.3	13.8	4	40
Shrubby layer											
1	*Plectranthus rugosus* Wall.ex Benth.	142	40.7	14.2	40.7	90.0	28.1	37.7	106.5	9	90
2	*Vibernum grandiflorum* Wall. Ex. DC.	3	0.9	0.3	0.9	20.0	6.3	1.0	8.1	2	20
3	*Indigofera heterantha* Wall.	149	42.7	14.9	42.7	100.0	31.3	45.1	119.0	10	100
4	*Daphne oleoides* Schreb.	6	1.7	0.6	2.7	30.0	9.4	1.5	13.6	3	30
5	*Berberis lycium* Royle	34	9.7	3.4	9.7	40.0	12.5	11.4	33.6	4	40
6	*Rumex hastatus* D. Don.	15	4.3	1.5	4.3	40.0	12.5	2.0	18.8	4	40
Tree layer											
1	*Ailanthus altissima* (Miller) Swingle.	11	25.6	1.1	25.6	40.0	23.5	26.3	75.4	4	40
2	*Pinus wallichiana* A. B. Jackson.	26	60.5	2.6	60.5	80.0	47.1	50.7	158.2	8	80

3	*Ficus palmata* Forssk.	6	14.0	0.6	14.0	50.0	29.4	23.0	66.4	5	50

Table 1.2.1. Phytosociological attributes of Oona, Site One, Summer Season Chakesar Valley, Shangla.

	Species name		Community Attributes								
No	**Herbaceous Layer**	No	D	RD	F	RF	RCC	%	IV	NSP	C.C
1	*Bidens spp.*	20	2	1.8	50.0	5.1	2.8	1.8	9.6	5	50.0
2	*Oxalis corniculata* Linn.	114	11.4	10.1	40.0	4.1	3.9	10.1	18.1	4	40.0
3	*Stachys emodi* Hedge	150	15	13.3	70.0	7.1	8.8	13.3	29.3	7	70.0
4	*Parthenium spp.*	48	4.8	4.3	50.0	5.1	2.8	4.3	12.1	5	50.0
5	*Lepidium sativum* Linn.	20	2	1.8	60.0	6.1	2.0	1.8	9.9	6	60.0
6	*Cirsium wallichi* DC.	5	0.5	0.4	20.0	2.0	0.6	0.4	3.0	2	20.0
7	*Lathyrus aphaca* Linn.	3	0.3	0.3	10.0	1.0	0.3	0.3	1.6	1	10.0
8	*Polygonum glabrum* Willd.	16	1.6	1.4	50.0	5.1	5.8	1.4	12.3	5	50.0
9	*Brachiaria reptens* (L.) Stapf.	44	4.4	3.9	60.0	6.1	3.0	3.9	13.1	6	60.0
10	*Cannabis sativa* Linn.	109	10.9	9.7	70.0	7.1	6.6	9.7	23.4	7	70.0
11	*Artemisia japonica* Thunb., Fl. Jap.	95	9.5	8.4	60.0	6.1	5.8	8.4	20.4	6	60.0
12	*Salvia moorcroftiana* Wall.	7	0.7	0.6	30.0	3.1	2.2	0.6	5.9	3	30.0
13	*Aristida cynantha* Nees ex Steud.	58	5.8	5.1	60.0	6.1	3.0	5.1	14.3	6	60.0
14	*Megacodon stylophorus* (C. B. Clarke)	63	6.3	5.6	40.0	4.1	7.7	5.6	17.4	4	40.0
15	*Polygonum glabrum* Willd.	44	4.4	3.9	30.0	3.1	4.0	3.9	11.0	3	30.0
16	*Cynodon dactylon* (L.) Pers.	23	2.3	2.0	30.0	3.1	2.2	2.0	7.3	3	30.0
17	*Asplenium marium* L.	49	4.9	4.3	30.0	3.1	2.2	4.3	9.6	3	30.0
18	*Rumex persicaria* L.	25	2.5	2.2	10.0	1.0	1.7	2.2	4.9	1	10.0
19	*Conyza bonariensis* (Linn.) Cronquist	34	3.4	3.0	30.0	3.1	5.0	3.0	11.0	3	30.0
20	*Polygonum plebejum* R. Br.	25	2.5	2.2	20.0	2.0	4.4	2.2	8.6	2	20.0
21	*Heliotropium strigosum* Willd.	5	0.5	0.4	30.0	3.1	0.6	0.4	4.1	3	30.0

22	*Eclipta alba* Hassk.	66	6.6	5.9	30.0	3.1	4.7	5.9	13.6	3	30.0
23	*Poa annua* L.	45	4.5	4.0	20.0	2.0	1.9	4.0	8.0	2	20.0
24	*Amaranthes spinosus* Linn.	32	3.2	2.8	40.0	4.1	5.3	2.8	12.2	4	40.0
25	*Chenopodium album* Linn.	3	0.3	0.3	10.0	1.0	0.3	0.3	1.6	1	10.0
26	*Rubia cordifolia* Linn.	10	1	0.9	10.0	1.0	1.7	0.9	3.6	1	10.0
27	*Cyperus rotundus* L.	14	1.4	1.2	20.0	2.0	0.6	1.2	3.8	2	20.0
Shrubby Layer											
1	*Zanthoxylum armatum* DC.	72	7.2	41.1	60.0	50.0	48.3	41.1	139.4	5	50
2	*Thymus serphylum* Benth.	103	10.3	58.9	60.0	50.0	51.7	58.9	160.6	5	50
Tree layer											
1	*Ailanthus altissima* (Miller) Swingle	18	1.8	45.0	70.0	38.9	32.5	45.0	116.4	7	70
2	*Ficus palmata* Forssk.	8	0.8	20.0	40.0	22.2	22.9	20.0	65.1	4	40
3	*Melia azadarichta* Linn.	6	0.6	15.0	30.0	16.7	2.0	15.0	33.6	3	30
4	*Robinia pseudocacia* Linn.	4	0.4	10.0	20.0	11.1	3.1	10.0	24.2	2	20
5	*Morus alba* Linn.	4	0.4	10.0	20.0	11.1	39.5	10.0	60.6	2	20

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value, NSP= No of stands present and C.C= Constancy Class.

Table 1.2. 2. Phytosociological attributes of Oona, Site Two, Summer Season Chakesar Valley, Shangla.

	Name of Plants			Community Attributes						
S.No	Herbaceous Layer	No	D	R.D	F	RF	RCC	IV	CC	NSP
1	*Lepidium sativum* Linn.	42	4.2	2.9	30.0	6.0	2.4	11.3	30	3
2	*Cynodon dactylon* (L.) Pers.	780	78.0	54.4	80.0	16.0	37.3	107.7	80	8
3	*Poa anuua* L.	36	3.6	2.5	60.0	12.0	3.3	17.8	60	6
4	*Brachiaria reptens* (L.) Stapf.	10	1.0	0.7	20.0	4.0	2.1	6.8	20	2
5	*Conyza bonariansis* (Linn.) Cronquist	4	0.4	0.3	20.0	4.0	0.6	4.9	20	2
6	*Eriocloa spp.*	65	6.5	4.5	30.0	6.0	5.0	15.6	30	3
7	*Oxalis corniculata* Linn.	5	0.5	0.3	10.0	2.0	0.3	2.6	10	1
8	*Plantago lanceolata* Linn.	2	0.2	0.1	10.0	2.0	0.3	2.4	10	1
9	*Silene vulgaris* (Moench) Garcke	10	1.0	0.7	10.0	2.0	0.3	3.0	10	1
10	*Cyperus rotundus* L.	20	2.0	1.4	10.0	2.0	0.3	3.7	10	1
11	*Asplenium marinum* L.	50	5.0	3.5	10.0	2.0	4.4	9.9	10	1
12	*Dicliptra bupleuroides* Nees	15	1.5	1.0	10.0	2.0	1.8	4.8	10	1
13	*Ajuga bracteosa* Wallich ex Benth.	5	0.5	0.3	30.0	6.0	0.9	7.2	30	3
14	*Trifolium alexandrium* Linn.	10	1.0	0.7	10.0	2.0	0.3	3.0	10	1
15	*Saccharum spontanum* L.	147	14.7	10.2	50.0	10.0	11.3	31.5	50	5
16	*Lespedeza juncea* (Linn. F.) Pers.	105	10.5	7.3	40.0	8.0	12.5	27.8	40	4
17	*Artemisia scoparia* Waldst. & Kit.	10	1.0	0.7	10.0	2.0	1.8	4.5	10	1
18	*Plantigo ovata* Forssk.	2	0.2	0.1	10.0	2.0	1.8	3.9	10	1
19	*Salvia moorcroftiana* Wall.	2	0.2	0.1	20.0	4.0	2.1	6.2	20	2
20	*Rumex hastatus* D. Don..	75	7.5	5.2	20.0	4.0	9.3	18.5	20	2
21	*Eragrostis japonica* (Thunb.) Trin.	40	4.0	2.8	10.0	2.0	1.8	6.6	10	1

Shrubby layer										
1	*Indigofera hetrantha* Wall.	13	1.3	2.1	20.0	8.7	7.4	18.2	20	2
2	*Thymus serphylum* Benth.	11	1.1	1.7	20.0	8.7	3.3	13.7	20	2
3	*Segeretia thea* (Sbeck) M.C. Johnson.	82	8.2	13.0	50.0	21.7	15.9	50.7	50	25
4	*Plectranthus rugosus* Wall. ex Benth.	286	28.6	45.5	80.0	34.8	43.9	124.2	80	8
5	*Zanthoxylum armatum* DC.	82	8.2	13.0	30.0	13.0	12.6	38.7	30	3
6	*Berberis lycium* Royle.	155	15.5	24.6	30.0	13.0	16.8	54.5	30	3
Tree layer										
1	*Melia azadarichta* Linn.	2	0.2	100.0	20.0	100.0	100.0	300.0	20	2

Table 1.2.3. Phytosociological attributes of Oona, Site Three, Summer Season Chakesar Valley, Shangla.

	Name of Plants		Community Attributes							
No	**Herbaceous Layer**	No	D	RD	F	RF	RCC	IV	CC	NSP
1	*Brachiaria reptens* (L.) Stapf.	66	6.6	4.9	40.0	8.9	3.4	17.2	40	4
2	*Poa annua* L.	635	63.5	46.8	70.0	15.6	36.5	98.8	70	7
3	*Artemisia japonica* Thunb., Fl. Jap.	7	0.7	0.5	20.0	4.4	0.8	5.7	20	2
4	*Cynodon dactylon* (L.) Pers.	373	37.3	27.5	70.0	15.6	33.6	76.6	70	7
5	*Barleria cristata* L.	34	3.4	2.5	60.0	13.3	2.3	18.1	60	6
6	*Oxalis corniculata* Linn.	55	5.5	4.1	40.0	8.9	8.7	21.6	40	4
7	*Lepidium sativum* Linn.	12	1.2	0.9	40.0	8.9	1.5	11.3	40	4
8	*Plantigo ovata* Forssk.	7	0.7	0.5	40.0	8.9	1.5	10.9	40	4
9	*Saccharum spontanum* L.	161	16.1	11.9	40.0	8.9	10.6	31.3	40	4
10	*Conyza aegyptiaca* L.	8	0.8	0.6	30.0	6.7	1.1	8.4	30	3
1	*Thymus serphylum* Benth.	456	45.6	42.3	90.0	21.8	40.8	104.8	90	9
Shrubby Layer										
2	*Ficus palmata* Forssk.	4	0.4	0.4	30.0	7.3	1.1	8.8	30	3

3	*Desmodium elegans* DC.	4	0.4	0.4	40.0	9.7	1.5	11.6	40	4
4	*Zanthoxylum armatum* DC.	15	1.5	1.4	3.0	0.7	3.1	5.2	3	3
5	*Buxus wallichiana* Baill.,	128	12.8	11.9	70.0	16.9	14.1	42.9	70	7
6	*Rubus fruticosus* L.	16	1.6	1.5	20.0	4.8	6.0	12.4	20	2
7	*Berberis lycium* Royle.	230	23.0	21.3	50.0	12.1	12.9	46.3	50	5
8	*Vibernum grandiflorum* Wall. Ex DC.	2	0.2	0.2	20.0	4.8	0.8	5.8	20	2
9	*Daphne oloides* Schreb.	24	2.4	2.2	30.0	7.3	1.1	10.6	30	3
10	*Sarcococca saligna* (D.Don) Muell.	200	20.0	18.5	60.0	14.5	18.6	51.6	60	6
Tree Layer										
1	*Pinus wallichiana* A. B. Jackson.	2	0.2	16.7	20.0	33.3	71.0	121.0	20	2
2	*Pinus roxburghii* Sargent.	1	0.1	8.3	10.0	16.7	8.4	33.4	10	1
3	*Quercus incana* Roxb.	9	0.9	75.0	30.0	50.0	20.5	145.5	30	3

Table 1.2.4. Phytosociological attributes of Oona, Site Four, Summer Season Chakesar Valley, Shangla.

	Name of Plants		Community Attributes							
S.No	**Herbaceous Layer**	No	D	RD	F	RF	RCC	IV	CC	NSP
1	*Polygonum plebejum* R. Br.	57	5.7	17.3	50.0	12.8	22.9	53.0	50	5
2	*Brachiaria reptens* (L.) Stapf.	44	4.4	13.3	60.0	15.4	14.8	43.5	60	6
3	*Cyperus rotundus* L.	4	0.4	1.2	20.0	5.1	1.0	7.3	20	2
4	*Cannabis sativa* Linn.	78	7.8	23.6	60.0	15.4	20.2	59.2	60	6
5	*Chenopodium album* Linn.	4	0.4	1.2	30.0	7.7	6.2	15.1	30	3
6	*Cynodon dactylon* (L.) Pers.	51	5.1	15.5	30.0	7.7	9.1	32.3	30	3
7	*Amaranthes spinosus* Linn.	6	0.6	1.8	30.0	7.7	3.8	13.4	30	3
8	*Polygonum barbatum* Linn.	36	3.6	10.9	60.0	15.4	7.7	34.0	60	6
9	*Sauromatum venosum* (Aiton) Kunth	50	5.0	15.2	50.0	12.8	14.3	42.3	50	5

Shrubby Layer										
1	*Thymus serphylum* Benth.	121	12.1	58.2	60.0	40.0	39.8	138.0	60	6
2	*Berberis lycium* Royle.	40	4.0	19.2	40.0	26.7	28.7	74.6	40	4
3	*Indigofera hetrantha* Wall.	47	4.7	22.6	50.0	33.3	31.5	87.4	50	5
Tree layer										
1	*Aesculus indica* (Colebr. Ex Cambess.) Hook.	1	0.1	4.3	10.0	4.5	9.4	18.2	10	1
2	*Juglan regia* L.	7	0.7	30.4	70.0	31.8	30.7	93.0	70	7
3	*Ficus palmata* Forssk.	4	0.4	17.4	40.0	18.2	17.9	53.5	40	4
4	*Diospyrus kaki* Linn.	5	0.5	21.7	40.0	18.2	2.8	42.7	40	4
5	*Prunus armeniaca* Linn.	3	0.3	13.0	30.0	13.6	5.4	32.1	30	3
6	*Melia azadarichta* Linn.	1	0.1	4.3	10.0	4.5	11.7	20.6	10	1
7	*Morus alba* Linn.	1	0.1	4.3	10.0	4.5	4.8	13.7	10	1
8	*Morus laevigata* Wall.	1	0.1	4.3	10.0	4.5	17.3	26.2	10	1

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value, NSP= No of stands present and C.C= Constancy Class.

Table 1.2.5. Phytosociological attributes of Oona, Site Five, Summer Season Chakesar Valley, Shangla.

			Community Attributes							
No	**Herbaceous Layer**	No	D	RD	F	RF	RCC	IV	CC	NSP
1	*Artemisia vulgare* L.	18	1.8	1.8	60.0	7.9	5.8	15.5	60	6
2	*Dichanthium annulatum* (Forssk.) Stapf.	322	32.2	32.3	70.0	9.2	26.3	67.8	70	7
3	*Centurium centroide*	17	1.7	1.7	50.0	6.6	1.8	10.1	50	5
4	*Pimpinella diversifolia* DC.	5	0.5	0.5	40.0	5.3	3.3	9.0	40	4
5	*Cynodon dactylon* (L.) Pers.	244	24.4	24.5	50.0	6.6	19.2	50.2	50	5
6	*Rumex hastatus* D. Don.	72	7.2	7.2	50.0	6.6	9.1	22.9	50	5
7	*Dicliptra bupleuroides* Nees	6	0.6	0.6	30.0	3.9	1.1	5.6	30	3
8	*Ajuga bracteosa* Wallich ex Benth.	8	0.8	0.8	40.0	5.3	6.5	12.6	40	4
9	*Brachiaria reptens* (L.) Stapf.	138	13.8	13.9	60.0	7.9	7.2	29.0	60	6
10	*Gnaphalium hypoleucum* DC.	12	1.2	1.2	40.0	5.3	5.1	11.6	40	4
11	*Salvia moorcroftiana* Wall.	3	0.3	0.3	40.0	5.3	1.1	6.7	40	4
12	*Solenanthus stamineus* (Desf)	6	0.6	0.6	40.0	5.3	3.3	9.1	40	4
13	*Arenebia benthamii* (Wall.) ex G. Don.	3	0.3	0.3	10.0	1.3	0.4	2.0	10	1
14	*Cenchrus ciliaris* L.	23	2.3	2.3	40.0	5.3	1.5	9.0	40	4
15	*Plantigo lanceolata* Linn.	1	0.1	0.1	20.0	2.6	0.4	3.1	20	2
16	*Sonchus arvensis* (DC) Kirp.	2	0.2	0.2	10.0	1.3	0.4	1.9	10	1
17	*Poa annua* L.	99	9.9	9.9	50.0	6.6	5.5	22.0	50	5
18	*Megacodon stylophorus* (C. B. Clarke)	2	0.2	0.2	10.0	1.3	0.4	1.9	10	1
19	*Hypericum perforatum* L.	4	0.4	0.4	10.0	1.3	0.4	2.1	10	1

20	*Conyza bonariansis* (Linn.) Cronquist	5	0.5	0.5	10.0	1.3	0.4	2.2	10	1
21	*Galium aparine* Linn.	4	0.4	0.4	10.0	1.3	0.4	2.1	10	1
22	*Bromus japonica* Thunb.	2	0.2	0.2	10.0	1.3	0.4	1.9	10	1
23	*Pennisetum orientale* Rich.	2	0.2	0.2	10.0	1.3	0.4	1.9	10	1
Shruby layer										
1	*Debregetia salisifolia* (D. Don) Renle.	59	5.9	14.9	40.0	23.5	13.2	51.6	40	4
2	*Berberis lycium* Royle.	119	11.9	30.1	60.0	35.3	31.5	96.9	60	6
3	*Indigofera hetrantha* Wall.	212	21.2	53.7	60.0	35.3	54.8	143.8	60	6
4	*Rubus fruticosus* L.	5	0.5	1.3	10.0	5.9	0.5	7.7	10	1
Tree Layer										
1	*Pinus wallichiana* A. B. Jackson.	15	1.5	27.3	30.0	17.6	3.7	48.7	30	3
2	*Ailanthus altissima* (Miller) Swingle	3	0.3	5.5	10.0	5.9	4.0	15.3	10	1
3	*Quercus dilatata* Lindl.	7	0.7	12.7	40.0	23.5	13.0	49.2	40	4
4	*Quercus incana* Roxb.	8	0.8	14.5	30.0	17.6	3.0	35.2	30	3
5	*Pinus roxburghii* Sargent.	15	1.5	27.3	30.0	17.6	15.5	60.4	30	3
6	*Salix tetrasperma* Roxb. Pl. Corom.	7	0.7	12.7	30.0	17.6	60.8	91.2	30	3

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value, NSP= No of stands present and C.C= Constancy Class.

Table 1.3.1 Phytosociological attributes of Oona, Site One, Winter Season Chakesar Valley, Shangla.

			Community Attributes							
No	**Species**	No	D	RD	F	RF	RCC	IV	C.C	NSP
1	*Cynodon dactylon* (L.) Pers.	15	1.5	15	30	16.7	9.5	41.1	30	3
2	*Medicago sativa* Linn.	11	1.1	11	40	22.2	4.7	38.0	40	4
3	*Ajuga bracteosa* Wallich ex Benth.	3	0.3	3	30	16.7	3.6	23.2	30	3
4	*Saccharum munja* Roxb.	71	7.1	71	80	44.4	82.2	197.7	80	8
5	*Debregetia salisifolia* (D. Don) Renle.	43	4.3	53.75	60	42.9	52.5	149.1	60	6
Shrubby layer										
2	*Berberis lycium* Royle.	30	3	37.5	40	28.6	37.5	103.6	40	4
3	*Zanthoxylum armatum* DC.	5	0.5	6.25	20	14.3	5.0	25.5	20	2
4	*Dodonea viscosa*	2	0.2	2.5	20	14.3	5.0	21.8	20	2
Tree layer										
1	*Morus alba* Linn.	2	0.2	18.2	20	25	12.4	55.6	20	2
2	*Ficus palmata* Forssk.	1	0.1	9.1	10	12.5	14.3	35.9	10	1
3	*Salix tetrasperma* Roxb. Pl. Corom.	1	0.1	9.1	10	12.5	8.3	29.9	10	1
4	*Melia azadarichta* Linn.	1	0.1	9.1	10	12.5	7.8	29.4	10	1
5	*Ailanthus altissima* (Miller) Swingle	5	0.5	45.5	20	25	32.5	103.0	20	2
6	*Diospyrus kaki* Linn.	1	0.1	9.1	10	12.5	24.7	46.3	10	1

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value, NSP= No of stands present and C.C= Constancy Class.

Table 1.3.2 Phytosociological attributes of Oona, Site Two, Winter Season Chakesar Valley, Shangla.

			Community Attributes							
No	**Herbaceous Layer**	No	D	RD	F	RF	RCC	IV	NSP	CC
1	*Saccharum munja* Roxb.	138	13.8	52.1	100.0	50.0	68.1	170.1	10	100
2	*Cynodon dactylon* (L.) Pers.	127	12.7	47.9	100.0	50.0	31.9	129.9	10	100
Shrubby Layer										
1	*Plectranthus rugosus* Wall. ex Benth.	256	25.6	60.5	90.0	47.4	54.4	162.3	9	90
2	*Berberis lycium* Royle.	145	14.5	34.3	60.0	31.6	38.1	104.0	6	60
3	*Indigofera hetrantha* Wall.	22	2.2	5.2	40.0	21.1	7.8	34.0	4	40
Tree Layer										
1	*Pinus roxburghii* Sargent.	3	0.3	60.0	30.0	60.0	83.4	203.4	3	30
2	*Pyrus pashia* Ham.	2	0.2	40.0	20.0	40.0	16.6	96.6	2	20

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value, NSP= No of stands present and C.C= Constancy Class.

Table 1.3.3 Phytosociological attributes of Oona, Site three, Winter Season Chakesar Valley, Shangla.

No	Species	No	Community Attributes							
			D	RD	F	RF	RCC	IV	CC	NSP
1	*Origanum vulgare* Linn.	168	16.8	92.3	100.0	62.5	95.9	250.7	100	10
2	*Micromaria biflora* (Ham.) Benth.	14	1.4	7.7	60.0	37.5	4.1	49.3	60	6
Shrubby Layer										
1	*Plectranthus rugosus* Wall. ex Benth.	258	25.8	95.2	100.0	90.9	90.5	276.6	100	10
2	*Sarcococca saligna* (D.Don) Muell.	13	1.3	4.8	10.0	9.1	9.5	23.4	10	1
Tree Layer										
1	*Pinus roxburghii* Sargent.	2	0.2	22.2	20.0	33.3	65.5	121.0	20	2
2	*Quercus dilatata* Lindl.	7	0.7	77.8	40.0	66.7	34.6	179.0	40	4

Table 1.3.4 Phytosociological attributes of Oona, Site Four, Winter Season Chakesar Valley, Shangla.

No	Species	No	Community Attributes							
			D	RD	F	RF	RCC	IV	CC	NSP
1	*Dactylis glomerata* L.	198	19.8	92.1	100.0	62.5	91.8	246.4	100	10
2	*Tagetes erecta* Linn.	17	1.7	7.9	60.0	37.5	8.2	53.6	60	6
Shruby Layer										
1	*Plectranthus rugosus* Wall. ex Benth.	165	16.5	100.0	100.0	100.0	100.0	300.0	100	10
Tree Layer										
1	*Juglan regia* L.	3	0.3	12.0	30.0	23.1	22.7	57.7	30	3
2	*Ailanthus altissima* (Miller) Swingle	22	2.2	88.0	100.0	76.9	77.3	242.3	100	10

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value, NSP= No of stands present and C.C= Constancy Class.

Table 1.3.5 Phytosociological attributes of Oona, Site Five, Winter Season Chakesar Valley, Shangla.

				Community Attributes						
No	Species	No	D	RD	F	RF	RCC	IV	CC	NSP
1	*Origanum vulgare* Linn.	15	1.5	11.4	20.0	13.3	11.2	35.9	20	2
2	*Verbascum thapsis* L.	4	0.4	3.0	30.0	20.0	4.8	27.8	30	3
3	*Tagetes erecta* Linn.	13	1.3	9.8	50.0	33.3	8.0	51.2	50	5
4	*Sorghum nephalensis* (L.) Hill.	100	10.0	75.8	50.0	33.3	76.0	185.1	50	5
Shruby Layer										
1	*Plectranthus rugosus* Wall. ex Benth.	88	8.8	43.6	70.0	43.8	45.0	132.3	70	7
2	*Berberis lycium* Royle.	114	11.4	56.4	90.0	56.3	55.6	168.2	90	9
Tree Layer										
1	*Quercus incana* Roxb.	2	0.2	6.7	20.0	16.7	14.3	37.7	20	2
2	*Pinus wallichiana* A. B. Jackson.	2	6.7	0.2	6.7	20.0	16.7	44.3	67.7	20
3	*Ailanthus altissima* (Miller) Swingle	17	56.7	1.7	56.7	40.0	33.3	19.7	109.7	40
4	*Olea ferruginea* Royle.	9	30.0	0.9	30.0	40.0	33.3	21.7	85.0	40

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value, NSP= No of stands present and C.C= Constancy Class.

Table.1.5 Communities attributes of Oona Hill Chakesar, District Shangla.

Site	Aspect	Stand	No of Plants	Species Richness	Index of Diversity	Index of Maturity	Equitability
Oona Hill	Spring	1	20	0.721	1.8	27	0.2
		2	12	0.371	1.8	32.5	0.24
		3	12	0.578	2.3	56.7	0.34
		4	11	0.446	1.8	58.2	0.25
		5	19	0.737	2.1	42.1	0.25
	Summer	1	34	0.928	3.11	31.5	0.32
		2	28	0.616	2.29	26.8	0.25
		3	23	0.464	2.2	40	0.25
		4	28	0.844	2.37	27.1	0.26
		5	34	0.868	2.44	32.4	0.25
	Winter	1	14	1.013	1.81	28.6	0.22
		2	7	0.265	1.5	62.9	0.21
		3	6	0.279	1	56.7	0
		4	5	0.248	1	78	0
		5	10	0.524	1.7	43	0.23

Table 1.7. Degree of homogeneity of Oona Hills, Chakesar Valley, District Shangla.

Stand No	Spring	Summer	Winter
1	A>B>C>D=E	A>B>C>D>E	A>B>C>D>E
2	A>B=C=D>E	A>B>C>D>E	A>B>C>D>E
3	A>B<C>D>E	A<B>C>D>E	A>B>C=D<E
4	A<B=C=D>E	A<B=C>D>E	A>B>C≤ ≥D<E
5	A<B>C=D<E	A<B>C>D>E	A=B>C=D=E

Table 1.8.1. Regeneration Capacity of Spring Flora of Oona Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Ailanthus altissima* (Miller) Swingle	11	7	6	2				
2	*Ficus racemosa* Linn.	9	5	2					
3	*Melia azadarichta* Linn.	3	1	1					
4	*Morus alba* Linn.		1						
5	*Morus nigra* L.		2						
6	*Olea ferruginea* Royle.		1						
7	*Pinus wallichiana* A. B. Jackson.	35	23	19	12	5	1		
8	*Quercus dilatata* Lindl.	12	10	15	8	2			
9	*Quercus incana* Roxb.	1	2	2	4	1			

Table 1.8.2. Regeneration Capacity of Summer Flora of Oona Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Aesculus indica* (Colebr. Ex Cambess.) Hook.		1						
2	*Ailanthus altissima* (Miller) Swingle	7	13	1					
3	*Diospyrus kaki* Linn.	5							
4	*Ficus racemosa* Linn.	7	3	2					
5	*Juglan regia* L.	2		4	3				

6	*Melia azadarichta* Linn.	9	2						
7	*Morus alba* Linn.		3						
8	*Morus laevigata* Wall.			1					
9	*Pinus roxburghii* Sargent.		6	4	3	2	1		
10	*Pinus wallichiana* A. B. Jackson.	5	6	5	1	2	2		
11	*Prunus persica* (Linn.) Batsh	1	2						
12	*Quercus dilatata* Lindl.		3	3	1				
13	*Quercus incana* Roxb.	4	4	3	5				
14	*Robinia pseudocacia* Linn.	4							
15	*Salix tetrasperma* Roxb. Pl. Corom.	3	3	1					

Table 1.8.3. Regeneration Capacity of Winter Flora of Oona Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Ailanthus altissima* (Miller) Swingle	11	19	13	1				
2	*Diospyrus kaki* Linn.	1							
3	*Ficus palmata* Forssk.		1						
4	*Juglan regia* L.	1		1	1	1			
5	*Melia azadarichta* Linn.	1							
6	*Morus alba* Linn.	1			1				
7	*Olea ferruginea* Royle.	1	2	3	3				
8	*Pinus roxburghii* Sargent.	1	1	1	1	1			
9	*Pinus wallichiana* A. B. Jackson.			1		1			
10	*Pyrus pashia* Ham.			1	1				
11	*Quercus dilatata* Lindl.	1	2	2		2			
12	*Quercus incana* Roxb.			1	1				
13	*Salix tetrasperma* Roxb. Pl. Corom.		1						

Table 1.6.Comparative indices of similarities between different seasons of Oona Hills Chakesar Valley, District Shangla.

Spring Season					
	BDD	SSP	PQP	ACF	PIC
BDD	0				
SSP	32	0			
PQP	42	79	0		
ACF	41	44	44	0	
PIC	49	59	59	100	0

Summer Season					
	TZA	PCB	QPT	TJI	IBS
TZA	0				
PCB	99	0			
QPT	70	87	0		
TJI	79	63	81	0	
IBS	68	97	94	63	0

Winter Season					
	SDB	PSP	POQ	PDA	SBP
SDB	0				
PSP	29	0			
POQ	0	31	0		
PDA	0	17	18	0	
SBP	8	24	25	40	0

Table 1. 8. Physiochemical analysis of Soil of Oona Hills, Chakesar, District Shangla.

No	Sites	Altitude	Soil Temperature	Location	Habitat	Textural of soil	Soil pH	EC	Ex.Na	Organic matter (%)	Nitrogen (%)	P (mg/kg)	Ex. K (mg/kg)
1	Dabb	1125M	24.9	N	moist	Sandy loam	6.4	0.31	0.4	1.59	0.099	12	190
2	Meragai	1275M	31.8	W	Dry	Loamy sand	6.5	0.13	0.3	1.21	0.076	8	90
3	Larchina	1400M	23.5	E	Moist	Sandy loam	6.4	0.1	0.3	0.06	0.004	4	40
4	Oona	1525M	24	N	moist	Loamy sand	6.5	0.07	0.2	1.4	0.088	5	50
5	Ram jany	1675M	22	Open	moist	Loamy sand	6.1	0.12	0.3	1.94	0.121	8	120

Table 1.9. Environmental variables of Oona hills, Chakesar valley, District Shangla.

Stands	Locations	Altitude	Temperature(F)	PAR Light (µM/mΛ2S)	Leaf wetness (LW)	Solar rad (Wat/m2)	RH (%)	WND (Deg)	WNS (mph)
1	Dabb	1125M	88.9	714	14	938	58.7	331	5
2	Meragai	1275M	88.6	710	1	1232	57.4	283	2
3	Larchina	1400M	87.4	647	13	1400	57.2	59	8
4	Oona	1525M	87.3	720	14	1450	52.1	340	5
5	Ram jany	1675M	85.6	630	13	1230	44.1	87	10

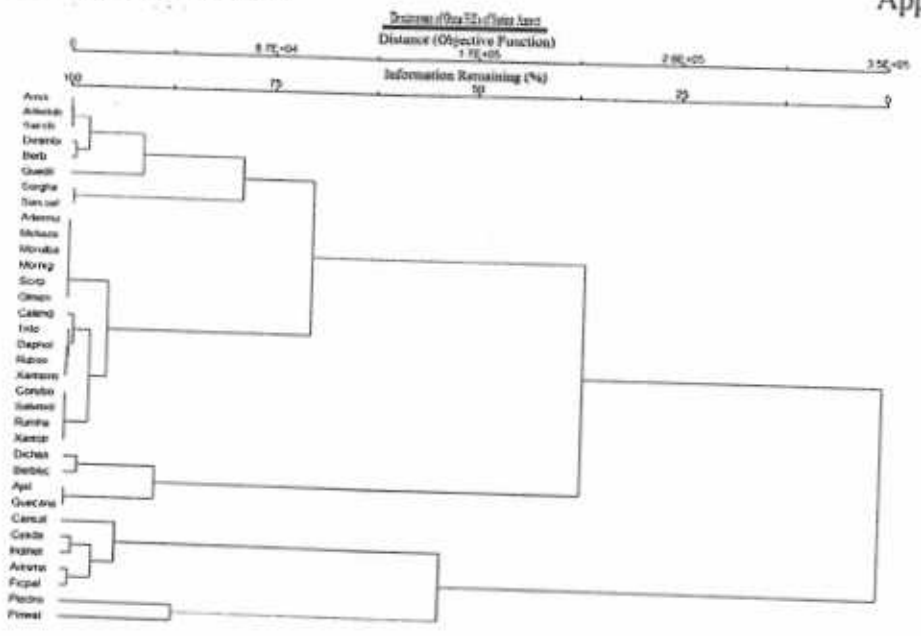


Fig. 1. Dendrogram of Oona Hills of Spring Aspect.

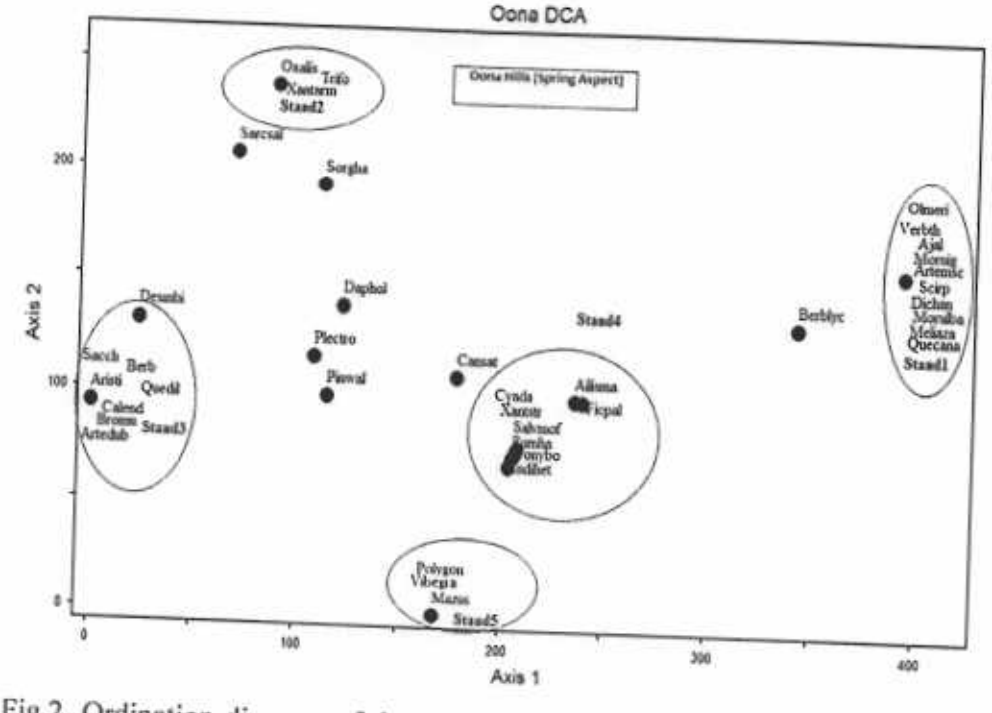


Fig.2. Ordination diagram of description of plant communities and out lier of Oona hill as demarcated by DCA.

Fig. 3. Two-Way Ordered Table of Oona Hills Chakesar Valley

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                 1 1123333323  1112222233 111232   123
                 92061345694767813503579129278806 1345428

1 Stand1         4555555555-5-------5---55--5----------        0
4 Stand4         ----------555--54555-55------5-------  0
5 Stand5         ----------455454444554355------5-------       0
2 Stand2         ----------455----------5455555-------         1
3 Stand3         ----------5----------5-5-5-55544555           1

                 00000000000000000000000011111111111111
                 00000000001111111111111110000000111111
                 01111111110011111111111110000001
```

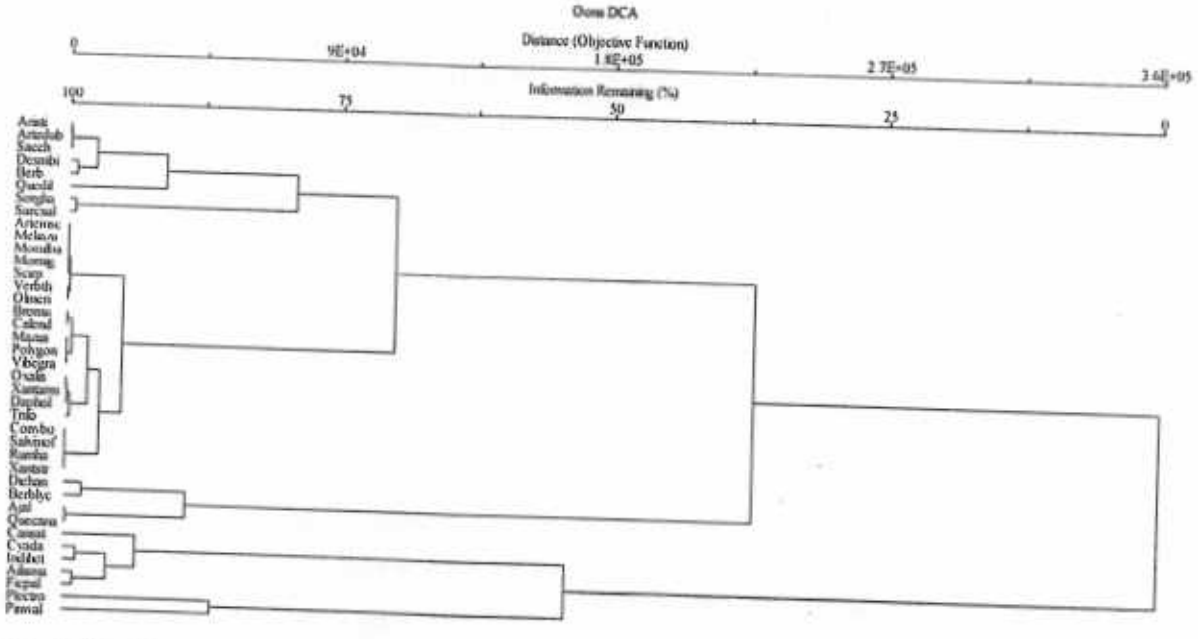
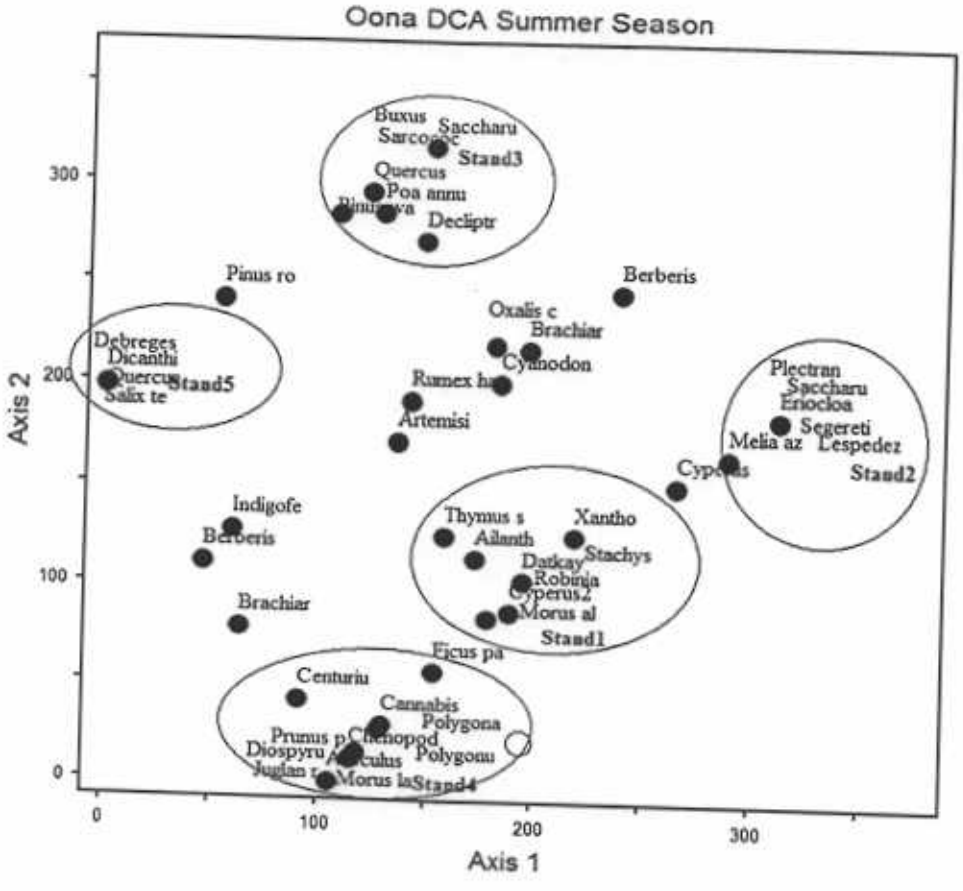


Fig. 5. Dendrogram of Oona Hills of Spring Aspect.

Fig.6. Ordination diagram of description of plant communities and out lier of Oona hill as demarcated by DCA.




```
                112441222444    112331122231234  11333  2 33344
                296476159125127815712340380024649786893546357O3

2  Stand2       -4----------335432445455555-----2---5----------  0
3  Stand3       -----5555555345-45-53---5---------------------  0
5  Stand5       555555---5554-5-3-5----------4--------545------  0
1  Stand1       -----3------5434-4-55------45555443555-2-2-----  1
4  Stand4       --------------5---55----------5355554555445555  1

                00000000000000000000000000111111111111111111111
                00000000000111111111111110000000000111111111111
                00000111111100000000011111100001111111000111111
```

Fig. 6. Two-way ordered table of Oona Hills Chakesar Valley.

Table 2.1.1. Phytosociological attributes of Gumrush, Site One, Spring Season Chakesar Valley, Shangla.

				Community Attributes						
	Species	No plants	%	D	RD	F	RF	RCC	IV	Constancy
1	*Conyza aegyptiaca* L.	138	28.5	13.8	28.5	60.0	14.3	37.9	80.6	60
2	*Conyza bonariansis* (Linn.) Cronquist	54	11.1	5.4	11.1	40.0	9.5	13.8	34.5	40
3	*Cynodon dactylon* (L.) Pers.	191	39.4	19.1	39.4	40.0	9.5	28.9	77.8	40
4	*Salvia moorcroftiana* Wall.	4	0.8	0.4	0.8	40.0	9.5	2.4	12.8	40
5	*Ajuga bracteosa* Wallich ex Benth.	4	0.8	0.4	0.8	70.0	16.7	4.2	21.7	70
6	*Oxalis corniculata* Linn.	5	1.0	0.5	1.0	20.0	4.8	1.2	7.0	20
7	*Euphorbia hirta* L.	16	3.3	1.6	3.3	30.0	7.1	1.8	12.3	30
8	*Calendula arvensis* Linn.	16	3.3	1.6	3.3	40.0	9.5	2.4	15.2	40
9	*Solanum nigrum* L.	15	3.1	1.5	3.1	20.0	4.8	1.2	9.1	20
10	*Xanthium strumarium* Linn	38	7.8	3.8	7.8	30.0	7.1	4.2	19.2	30
11	*Plantigo lanceolata* Linn.	4	0.8	0.4	0.8	30.0	7.1	1.8	9.8	30
Shrubby layer										
1	*Berberis lycium* Royle.	225	47.2	22.5	47.2	80.0	61.5	87.8	196.5	80
2	*Zanthoxylum armatum* DC.	252	52.8	25.2	52.8	50.0	38.5	12.2	103.5	50
Tree Layer										
1	*Juglan regia* L.	3	7.1	0.3	7.1	10.0	10.0	52.0	69.1	10
2	*Ailanthus altissima* (Miller) Swingle	21	50.0	2.1	50.0	50.0	50.0	15.8	115.8	50
3	*Melia azadarichta* Linn.	11	26.2	1.1	26.2	20.0	20.0	10.0	56.2	20
4	*Morus nigra* L.	7	16.7	0.7	16.7	20.0	20.0	22.3	59.0	20

Table 2.1.2 Phytosociological attributes of Gumrush, Site Two, Spring Season Chakesar Valley, Shangla.

				Community Attributes						
No	Species	No plants	%	D	RD	F	RF	RCC	IV	Constancy
1	*Pennisetum orientale* Rich.	386	55.1	38.6	55.1	100.0	27.8	58.0	140.9	100
2	*Themeda anathera* (Nees ex Steud.) Hack.	65	9.3	6.5	9.3	30.0	8.3	6.2	23.8	30
3	*Salvia moorcroftiana* Wall.	3	0.4	0.3	0.4	30.0	8.3	6.2	15.0	30
4	*Calendula arvensis* Linn.	70	10.0	7.0	10.0	50.0	13.9	7.2	31.0	50
5	*Euphorbia hirta* L.	20	2.9	2.0	2.9	40.0	11.1	2.4	16.3	40
6	*Conyza aegyptiaca* L.	9	1.3	0.9	1.3	20.0	5.6	1.0	7.8	20
7	*Amaranthes spinosus* Linn.	4	0.6	0.4	0.6	30.0	8.3	5.7	14.6	30
8	*Eragrostis japonica* (Thunb.) Trin.	94	13.4	9.4	13.4	40.0	11.1	12.4	36.9	40
9	*Micromaria biflora* (Ham.) Benth.	50	7.1	5.0	7.1	20.0	5.6	1.0	13.6	20
Shrubby Layer										
1	*Berberis lycium* Royle.	161	92.0	16.1	92.0	80.0	72.7	81.4	246.1	80
2	*Zanthoxylum armatum* DC.	14	8.0	1.4	8.0	30.0	27.3	18.6	53.9	30
Tree layer										
1	*Pyrus pashia* Ham.	3	30.0	0.3	30.0	20.0	22.2	28.1	80.4	20
2	*Morus nigra* L.	2	20.0	0.2	20.0	20.0	22.2	21.3	63.5	20
3	*Salix tetrasperma* Roxb. Pl. Corom.	2	20.0	0.2	20.0	20.0	22.2	23.1	65.3	20
4	*Olea ferruginea* Royle.	3	30.0	0.3	30.0	30.0	33.3	27.5	90.8	30

Table 2.2.3. Phytosociological attributes of Gumrush, Site Three, Spring Season Chakesar Valley, Shangla.

				Community Attributes						
No	Species	No plants	%	D	RD	F	RF	RCC	IV	Constancy
1	*Pennisetum orientale* Rich.	322	64.8	32.2	64.8	90.0	24.3	58.1	147.2	90
2	*Dichanthium annulatum* (Forssk.) Stapf.	96	19.3	9.6	19.3	70.0	18.9	25.5	63.8	70
3	*Themeda anathera* (Nees ex Steud.) Hack.	27	5.4	2.7	5.4	30.0	8.1	4.5	18.0	30
4	*Ajuga bracteosa* Wallich ex Benth.	7	1.4	0.7	1.4	40.0	10.8	1.5	13.7	40
5	*Convolulus arvensis* L.	9	1.8	0.9	1.8	50.0	13.5	1.9	17.2	50
6	*Conyza aegyptiaca* L.	22	4.4	2.2	4.4	40.0	10.8	6.6	21.9	40
7	*Nasturtium officinalis* Linn.	4	0.8	0.4	0.8	20.0	5.4	0.7	7.0	20
8	*Galium aparine* Linn.	10	2.0	1.0	2.0	30.0	8.1	1.1	11.2	30
Shrubby layer										
1	*Punica granata* L.	5	2.1	0.5	2.1	10.0	5.9	0.9	8.9	10
2	*Berberis lycium* Royle.	192	82.1	19.2	82.1	90.0	52.9	84.6	219.6	90
3	*Indigofera hetrantha* Wall.	37	15.8	3.7	15.8	70.0	41.2	14.5	71.5	70
Tree layer										
1	*Quercus baloot* Griff., Itin. Not.	20	38.5	2.0	38.5	80.0	40.0	31.7	110.2	80
2	*Ficus palmata* Forssk.	1	1.9	0.1	1.9	10.0	5.0	16.0	22.9	10
3	*Pinus wallichiana* A. B. Jackson.	28	53.8	2.8	53.8	80.0	40.0	42.6	136.4	80
4	*Pyrus pashia* Ham.	3	5.8	0.3	5.8	30.0	15.0	9.7	30.5	30

Table 2.2.4. Phytosociological attributes of Gumrush. Site Four, Spring Season Chakesar Valley, Shangla.

	Herbaceous layer			Community Attributes					
No	**Species**	No plants	%	D	RD	F	RF	RCC	IV
1	*Circium wallichi* DC.	10	1.28	1	1.28	50.00	5.26	21.00	27.55
2	*Brachiaria reptens* (Linn.) Stapf.	140	17.88	14	17.95	90.00	9.47	22.00	49.42
3	*Salvia moorcroftiana* Wall.	5	0.64	0.5	0.64	40.00	4.21	1.00	5.85
4	*Duchesnia indica* forssk.	225	28.74	22.5	28.85	100.00	10.53	18.00	57.37
5	*Adiantum incisum* Forssk.	110	14.05	11	14.10	60.00	6.32	5.00	25.42
6	*Arisaema flavum* (Forssk.) Schott.	23	2.94	2.3	2.95	70.00	7.37	6.00	16.32
7	*Urtica dioca* Linn.	34	4.34	3.4	4.36	50.00	5.26	3.00	12.62
8	*Galium aparine* Linn.	34	4.34	3.4	4.36	60.00	6.32	2.00	12.67
9	*Crysanthemum leucanthemum* L.	35	4.47	3.5	4.49	50.00	5.26	6.00	15.75
10	*Oxalis corniculata* Linn.	45	5.75	4.5	5.77	80.00	8.42	3.00	17.19
11	*Rumex hastatus* D. Don	46	5.87	4.6	5.90	90.00	9.47	3.00	18.37
12	*Polygonum barbatum* L.	26	3.32	2.6	3.33	80.00	8.42	4.00	15.75
13	*Ajuga bracteosa* Wallich ex Benth.	5	0.64	0.5	0.64	40.00	4.21	2.00	6.85
14	*Plantigo lanceolata* Linn	45	5.75	4.5	5.77	90.00	9.47	4.00	19.24
Shrubby layer									
1	*Isodon rugosus* (Wall. Ex Benth)	23	22.12	2.3	22.12	60.00	27.27	23.00	72.39
2	*Berberis lyceum* Royle.	36	34.62	3.6	34.62	90.00	40.91	43.00	118.52
3	*Cotoneaster nummularia* Fish & Mey	45	43.27	4.5	43.27	70.00	31.82	34.00	109.09

Table 2.2.5. Phytosociological attributes of Gumrush, Site Five, Spring Season Chakesar Valley, Shangla.

				Community Attributes							
	Name of the specie	No of Plants	%	Density	RD	F	RF	RD+RF	RCC	IV	Constancy
No	**Herbaceous layer**										
1	*Conyza bonnarensis* (Linn.) Cronquist.	95	32.0	9.5	32.0	90	30	62.0	25.9	87.9	90
2	*Brachiaria reptens* (Linn.) Stapf.	22	7.4	2.2	7.4	30	10	17.4	11.3	28.7	30
3	*Poa annua* L.	165	55.6	16.5	55.6	50	16.7	72.2	23.7	95.9	50
4	*Impatiens balsamina* L.	6	2.0	0.6	2.0	50	16.7	18.7	10.0	28.7	50
5	*Arisaema flavum* (Forssk.) Schott.	3	1.0	0.3	1.0	30	10.0	11.0	9.2	20.2	30
6	*Cirsium wallichi* DC.	2	0.7	0.2	0.7	20	6.7	7.3	16.6	24.0	20
7	*Gnaphalium stewartii* C.B. Clarke.	4	1.3	0.4	1.3	30	10.0	11.3	3.3	14.7	30
Shruby Layer											
1	*Sarcococa saligna* (D.Don) Muell.	14	5.4	1.4	5.4	10	5.6	11.0	0.5	11.5	10
2	*Vitis vinifera* L.	3	1.2	0.3	1.2	20	11.1	12.3	3.8	16.1	20
3	*Hedera helix* L.	3	1.2	0.3	1.2	30	16.7	17.8	3.3	21.1	30
4	*Rosa macrophylla* Lindl.	47	18.2	4.7	18.2	40	22.2	40.4	27.3	67.8	40
5	*Plectranthus rugosus* Wall ex Benth.	11	4.3	1.1	4.3	20	11.1	15.4	11.3	26.7	20
6	*Berberis lyceum* Royle.	180	69.8	18	69.8	60	33.3	103.1	53.8	156.9	60
Tree layer											
1	*Quercus dilatata* Lindl.	17	54.8	1.7	54.8	40	30.8	85.6	29.3	114.9	40
2	*Celtis australis* Wild.	11	35.5	1.1	35.5	60	46.2	81.6	45.7	127.3	60
3	*Morus alba* L.	3	9.7	0.3	9.7	30	23.1	32.8	24.9	57.7	30

Table 2.2.1. Phytosociological attributes of Gumrush, Site One, Summer Season Chakesar Valley, Shangla.

			Community Attributes						
No	Name of the species	No	D	RD	F	RF	RCC	IV	Constancy
1	*Cynodon dactylon* (L.) Pers.	435	43.5	52.0	70	15.9	27.24	**95.18**	70
2	*Conyza bonnarensis* (Linn.) Cronquist.	137	13.7	16.3	90	20.4	17.24	**54.08**	90
3	*Pasphalum*	30	3	3.58	20	4.54	10.06	**18.19**	20
4	*Oxalis pes capre* Linn.	40	4	4.78	40	9.09	1.31	**15.18**	40
5	*Mentha arvensis*	4	0.4	0.47	10	2.27	0.327	**3.078**	10
6	*Centurium centroide*	34	3.4	4.06	30	6.81	6.205	**17.09**	30
7	*Sonchus arvensis* (DC.) Karp.	9	0.9	1.07	10	2.27	2.286	**5.635**	10
8	*Verbescum thapsis* L.	9	0.9	1.07	20	4.54	0.653	**6.275**	20
9	*Sarghum nephalensis* (L.) Hill.	17	1.7	2.03	10	2.27	5.16	**9.466**	10
10	*Heliotropium strigossum* Willd.	2	0.2	0.23	10	2.27	0.327	**2.838**	10
11	*Duchesnia indica* forssk.	4	0.4	0.47	10	2.27	0.327	**3.078**	10
12	*Cenchrus ciliaris* L.	14	1.4	1.67	10	2.27	4.833	**8.780**	10
13	*Crysanthemum leucanthemum* L.	14	1.4	1.67	10	2.27	4.833	**8.780**	10
14	*Galium aparine* Linn.	50	5	5.9	20	4.5	2.286	**12.8**	20
15	*Artemisia dubia* Wall.	7	0.7	0.83	20	4.54	3.919	**9.3**	20
16	*Micromaria biflora* (Hams.) Benth.	10	1	1.19	10	2.27	0.327	**3.79**	10
17	*Lespedeza juncea* (Linn. F.) Pers.	6	0.6	0.71	10	2.27	0.327	**3.31**	10
18	*Xanthium strumarium*	1	0.1	0.1	10	2.27	8.099	**10.49**	10
19	*Solanum nigrum* L.	1	0.1	0.11	10	2.27	1.96	**4.35**	10
20	*Poa annua* L.	10	1	1.19	10	2.27	0.327	**3.79**	10
21	*Ajuga parviflora* Benth.	2	0.2	0.23	10	2.27	1.96	**4.47**	10

Shrubby Layer									
1	*Berberis lycium* Royle.	184	18.4	53.33333	60	42.85714	36.027	**132.2175**	60
2	*Rubis fruiticosis* L.	45	4.5	13.04348	30	21.42857	25.632	**60.10405**	30
3	*Indigofera hetrantha* Wall.	116	11.6	33.62319	50	35.71429	38.337	**107.6745**	50
Tree layer									
1	Ailanthus altissima	10	1	23.80952	30	23.07692	15.25	**62.13645**	30
2	Pyrus pasia	2	0.2	4.761905	10	7.692308	3.827	**16.28121**	10
3	Populus indica	11	1.1	26.19048	40	30.76923	15.31	**72.26971**	40
4	Pyrus communis	16	1.6	38.09524	20	15.38462	9.07	**62.54985**	20
5	Prunus armenica	2	0.2	4.761905	20	15.38462	36.14	**56.28652**	20
6	Acacia Arabica	1	0.1	2.380952	10	7.692308	20.41	**30.48326**	10

Table 2.2.2. Phytosociological attributes of Gumrush, Site Two, Summer Season Chakesar Valley, Shangla.

No	Name of the specie	No of Plants	%	Community Attributes						
				Density	RD	F	RF	RCC	IV	Constancy
1	*Conyza bonnarensis* (Linn.) Cronquist.	95	31.99	9.5	32.0	90	30	25.9	87.9	90
2	*Brachiaria reptens* (Linn.) Stapf.	22	7.41	2.2	7.4	30	10	11.3	28.7	30
3	*Poa annua* L.	165	55.56	16.5	55.6	50	16.6	23.7	95.9	50
4	*Impatiens balsamina* L.	6	2.02	0.6	2.0	50	16.6	10.0	28.7	50
5	*Arisaema flavum* (Forssk.) Schott.	3	1.01	0.3	1.0	30	10	9.2	20.2	30
6	*Cirsium wallichi* DC.	2	0.67	0.2	0.7	20	6.6	16.6	24.0	20
7	*Gnaphalium stewartii* C.B. Clarke.	4	1.35	0.4	1.3	30	10	3.3	14.7	30
1	*Sarcococa saligna* (D.Don) Muell.	14	5.43	1.4	5.4	10	5.5	0.5	11.5	10
2	*Vitis vinifera* L.	3	1.16	0.3	1.2	20	11.1	3.8	16.1	20
3	*Hedera helix* L.	3	1.16	0.3	1.2	30	16.6	3.3	21.1	30
4	*Rosa macrophylla* Lindl.	47	18.22	4.7	18.2	40	22.2	27.3	67.8	40
5	*Plectranthus rogosus* Wall ex Benth.	11	4.26	1.1	4.3	20	11.1	11.3	26.7	20
6	*Berberis lycium* Royle.	180	69.77	18	69.8	60	33.3	53.8	156.9	60
1	*Quercus dilatata* Lindl.	17	54.84	1.7	54.8	40	30.76	29.3	114.9	40
2	*Celtis australis* Wild.	11	35.48	1.1	35.5	60	46.1	45.7	127.3	60
3	*Morus alba* L.	3	9.68	0.3	9.7	30	23.0	24.9	57.7	30

Table 2.2.3. Phytosociological attributes of Gumrush, Site Three, Summer Season Chakesar Valley, Shangla.

No	Name of the specie	No of Plants	Community Attributes						
			D	RD	F	RF	RCC	IV	Constancy
Herbs layer									
1	*Poa annua* L.	356	35.6	33.9	80	11.5	32.52	78.05	80
2	*Cynodon dactylon* (L.) Pers.	145	14.5	13.822	40	5.7	11.13	30.74	40
3	*Plantigo major*	16	1.6	1.52	40	5.7	3.055	10.3	40
4	*Ajuga bracteosa*	8	0.8	0.762	30	4.34	1.018	6.12	30
5	*Conyza bonnarensis* (Linn.) Cronquist	16	1.6	1.52	40	5.79	1.358	8.68	40
6	*Chenjanwale*	25	2.5	2.3	40	5.79	3.055	11.2	40
7	*Sonchus asper*	3	0.3	0.28	30	4.34	1.018	5.6	30
8	*Pesholama*	281	28.1	26.7	60	8.69	16.5	51.9	60
9	*Tagetis minuta*	94	9.4	8.9	50	7.24	17.45	33.6	50
10	*Aster*	12	1.2	1.14	20	2.89	0.679	4.72	20
11	*Saussoria*	2	0.2	0.19	20	2.89	0.679	3.76	20
12	*Hypericum*	8	0.8	0.76	30	4.34	1.018	6.12	30
13	*Artemisia dubia* Wall.	29	2.9	2.76	30	4.34	4.752	11.8	30
14	*Artemisia scoparia*	5	0.5	0.47	10	1.4	0.339	2.26	10
15	*Brachiaria reptens* (Linn.) Stapf.	24	2.4	2.2	50	7.24	1.358	10.89	50
16	*Oxalis corniculata*	3	0.3	0.28	10	1.44	0.339	2.074	10
17	*Solanum nigrum*	5	0.5	0.476	10	1.44	0.679	2.6	10
18	*Amaranthus viridus*	2	0.2	0.19	20	2.89	0.339	3.428	20
19	*Heliotropium strigossum* Willd.	5	0.5	0.47	20	2.89	1.08	4.45	20
20	*Medicago sativa*	4	0.4	0.38	30	4.34	0.679	5.40	30
21	*Ajuga parviflora* Benth.	6	0.6	0.57	30	4.34	1.018	5.93	30
Shrubby layer									
1	*Berberis lycium* Royle.	360	36	85.91885	80	44.44444	83.22	213.5833	80

2	*Rubis fruiticosis* L.	23	2.3	5.48926	40	22.22222	4.474	32.18548	40
3	*Indigofera hetrantha* Wall.	36	3.6	8.591885	60	33.33333	12.3	54.22522	60
Tree layer									
1	*Quercus incana*	3	0.3	50	30	50	38.61	138.61	50
2	*Pyrus communis*	3	0.3	50	30	50	61.36	161.36	50

Table 2.2.4. Phytosociological attributes of Gumrush, Stand Four, Summer Season Chakesar Valley, Shangla.

No	Name of the specie	No of Plants	Community Attributes						Constancy
			D	RD	F	RF	RCC	IV	
Herbs layer									
1	*Cannabis sativa* L.	174	17.4	14.82112	50	8.064516	15.28	38.16564	50
2	*Sonchus arvensis* (DC.) Karp.	7	0.7	0.596252	40	6.451613	1.284	8.331865	40
3	*Galium aparine* Linn.	13	1.3	1.107325	40	6.451613	1.284	8.842938	40
4	*Poa annua* L.	255	25.5	21.72061	60	9.677419	23.23	54.62803	60
5	*Brachiaria reptens* (Linn.) Stapf.	14	1.4	1.192504	30	4.83871	0.963	6.994214	30
6	*Arisaema flavum* (Forssk.) Schott.	11	1.1	0.936968	40	6.451613	4.493	11.88158	40
7	*Impatiens balsamina* L.	100	10	8.517888	50	8.064516	12.77	29.3524	50
8	*Adiantum*	70	7	5.962521	40	6.451613	4.493	16.90713	40
9	*Taraxicum officinale*	4	0.4	0.340716	40	6.451613	2.054	8.846328	40
10	*Plantigo ovate*	12	1.2	1.022147	30	4.83871	4.172	10.03286	30
11	*Fimbristalis squarrosa*	475	47.5	40.45997	90	14.51613	25.8	80.77609	90
12	*Pteris*	22	2.2	1.873935	30	4.83871	1.284	7.996645	30
13	*Verbescun thapsis*	3	0.3	0.255537	30	4.83871	1.284	6.378246	30
14	*Conyza aegyptica*	8	0.8	0.681431	30	4.83871	0.963	6.483141	30
15	*Lolium*	6	0.6	0.511073	20	3.225806	0.642	4.37888	20

Shrubby Layer									
1	*Berberis lycium* Royle.	325	32.5	42.26268	90	31.69014	58.44	132.3928	90
2	*Spirea corymbosa*	36	3.6	4.681404	50	17.60563	8.658	30.94504	50
3	*Indigofera hetrantha* Wall.	163	16.3	21.19636	50	17.60563	1.443	40.24499	50
4	*Thymus serphylum*	208	20.8	27.04811	60	21.12676	25.69	73.86487	60
5	*Arundo donax*	25	2.5	3.250975	30	10.56338	0.722	14.53636	30
6	*Hedera helix* L.	12	1.2	1.560468	40	1.408451	5.051	8.019919	40
Tree layer									
1	*Diospyrus kaki*	5	0.5	23.80952	30	15	1.767	40.57652	30
2	*Alianthus altissima*	3	0.3	14.28571	50	25	1.566	40.85171	50
3	*Ficus palmate*	2	0.2	9.52381	20	10	0.328	19.85181	20
4	*Diospyrus lotus*	3	0.3	14.28571	30	15	1.967	31.25271	30
5	*Salix babylonica*	1	0.1	4.761905	10	5	41.88	51.6419	10
6	*Morus alba* L.	2	0.2	9.52381	10	5	2.933	17.45681	10
7	*Quercus incana*	4	0.4	19.04762	40	20	2.86	41.90762	40
8	*Platinus orientalis*	1	0.1	4.761905	10	5	46.96	56.7219	10

Table 2.2.5. Phytosociological attributes of Gumrush, Stand Five, Summer Season Chakesar Valley, Shangla.

	Name of the specie	No of Plants	Community Attributes						Constancy
			D	RD	F	RF	RCC	IV	
Herbaceous layer									
1	*Cynodon dactylon* (L.) Pers.	850	85	72.40204	100	18.51852	10.5	101.4206	100
2	*Sorghum nephalensis*	59	5.9	5.025554	40	7.407407	30.5	42.93296	40
3	*Nepeta erecta*	18	1.8	1.53322	30	5.555556	5.6	12.68878	30
4	*Ajuga parviflora* Benth.	11	1.1	0.936968	40	7.407407	3.5	11.84438	40
5	*Conyza bonnarensis* (Linn.) Cronquist.	9	0.9	0.76661	30	5.555556	12.4	18.72217	30
6	*Solanum nigrum* L.	7	0.7	0.596252	30	5.555556	2.6	8.751808	30
7	*Galium aparine* Linn.	30	3	2.555366	50	9.259259	2.5	14.31463	50
8	*Oxalis pescapre*	15	1.5	1.277683	30	5.555556	2.6	9.433239	30
9	*Heliotropium strigossum* Willd.	5	0.5	0.425894	20	3.703704	3.4	7.529598	20
10	*Lolium*	4	0.4	0.340716	30	5.555556	1.5	7.396271	30
11	*Arisaema jacqumontii*	2	0.2	0.170358	20	3.703704	6.4	10.27406	20
12	*Sonchus arvensis* (DC.) Karp.	33	3.3	2.810903	40	7.407407	4.7	14.91831	40
13	*Centurium centroide*	62	6.2	5.28109	30	5.555556	8.4	19.23665	30
14	*Micromaria*	69	6.9	5.877342	50	9.259259	5.6	20.7366	50
Shruby layer									
1	*Berberis lycium* Royle.	155	15.5	39.24051	40	25	34.5	98.74051	40
2	*Thymus serphylum*	65	6.5	16.4557	40	25	40.3	81.7557	40
3	*Sarcococa saligna* (D.Don) Muell.	121	12.1	30.63291	40	25	23.2	78.83291	40
4	*Desmodium*	54	5.4	13.67089	40	25	2.4	41.07089	40

Winter Aspect

Table 2.3.1 Phytosociological attributes of Gumrush, Site One, Winter Season Chakesar Valley, Shangla.

				Community Attributes						
No	Herbaceous Layer	No	Ra	D	RD	F	RF	RCC	IV	Constancy
1	*Chenopodium album* Linn.	12	11.7	1.2	11.7	50.0	20.8	10.5	43.0	50
2	*Tagetes erecta* Linn.	24	23.3	2.4	23.3	80.0	33.3	18.9	75.5	80
3	*Rumex hastatus* D. Don..	48	46.6	4.8	46.6	40.0	16.7	62.2	125.5	40
4	*Conyza aegyptiaca* L.	16	15.5	1.6	15.5	40.0	16.7	5.3	37.5	40
5	*Plantigo lanceolata* Linn.	3	2.9	0.3	2.9	30.0	12.5	3.2	18.6	30
Shruby layer										
1	*Berberis lycium* Royle.	115	95.0	11.5	95.0	100.0	76.9	97.2	269.2	100
2	*Rubus fruticosus* L.	6	5.0	0.6	5.0	30.0	23.1	2.8	30.8	30

Table2.3.2 Phytosociological attributes of Gumrush, Site Two, Winter Season Chakesar Valley, Shangla.

				Community Attributes						
No	**Herbaceous Layer**	No	Ra	D	RD	F	RF	RCC	IV	Constancy
1	*Cenchrus ciliaris* L.	55	91.7	5.5	34.4	50.0	20.8	32.1	87.3	50
2	*Tagetes erecta* Linn.	22	36.7	2.2	13.8	60.0	25.0	19.2	58.0	60
3	*Conyza aegyptiaca* L.	56	93.3	5.6	35.0	50.0	20.8	30.1	85.9	50
4	*Rumex hastatus* D. Don..	24	40.0	2.4	15.0	50.0	20.8	17.0	52.8	50
5	*Cirsium wallichi* DC.	3	5.0	0.3	1.9	30.0	12.5	1.6	16.0	30
Shruby layer										
1	*Zanthoxylum armatum* DC.	77	57.5	7.7	57.5	90.0	60.0	55.8	173.2	90
2	*Berberis lycium* Royle.	57	42.5	5.7	42.5	60.0	40.0	44.5	127.0	60

Table 2.3.3 Phytosociological attributes of Gumrush, Site Three, Winter Season Chakesar Valley, Shangla.

				Community Attributes						
	Herbaceous Layer	No	Ra	D	RD	F	RF	RCC	IV	Constancy
1	*Amaranthus viridis* L.	40	13.0	4.0	13.0	90.0	31.0	18.9	62.9	90
2	*Rumex dentatus* Linn.	38	12.3	3.8	12.3	40.0	13.8	16.4	42.5	40
3	*Tagetes erecta* Linn.	12	3.9	1.2	3.9	30.0	10.3	4.0	18.2	30
4	*Cynodon dactylon* (L.) Pers.	88	28.6	8.8	28.6	30.0	10.3	22.9	61.8	30
5	*Cenchrus ciliaris* L.	124	40.3	12.4	40.3	60.0	20.7	35.7	96.6	60
6	*Ajuga bracteosa* Wallich ex Benth.	6	1.9	0.6	1.9	40.0	13.8	2.0	17.7	40
Shruby layer										
1	*Berberis lycium* Royle.	89	100.0	8.9	100.0	70.0	100.0	100.0	300.0	70
Tree layer										
2	*Ailanthus altissima* (Miller) Swingle	212	50.6	21.2	50.6	70.0	58.3	60.5	169.4	70
3	*Morus alba* Linn.	103	24.6	10.3	24.6	20.0	16.7	12.1	53.3	20
4	*Diospyrus kaki* Linn.	104	24.8	10.4	24.8	30.0	25.0	27.6	77.4	30

Table 2.3.4 Phytosociological attributes of Gumrush, Site Four, Winter Season Chakesar Valley, Shangla.

				Community Attributes						
	Herbaceous Layer	No	Ra	D	RD	F	RF	RCC	IV	Constancy
1	*Cenchrus ciliaris* L.	127	45.2	12.7	45.2	100.0	45.5	43.5	134.2	100.0
2	*Chrysopogon aucheri* (Boiss.) Stapf	59	21.0	5.9	21.0	60.0	27.3	19.0	67.3	60.0
3	*Conyza bonariansis* (Linn.) Cronquist	95	33.8	9.5	33.8	60.0	27.3	37.0	98.1	60.0
4	*Ajuga bracteosa* Wallich ex Benth.	281	100.0	28.1	100.0	220.0	100.0	100.0	300.0	220.0
Shruby layer										
1	*Debregetia salisifolia* (D. Don) Renle.	141	58.8	14.1	58.8	90.0	60.0	65.0	183.8	90.0

2	*Berberis lycium* Royle.	99	41.3	9.9	41.3	60.0	40.0	35.0	116.3	60.0
Tree layer										
1	*Pinus wallichiana* A. B. Jackson.	42	93.3	4.2	93.3	100.0	76.9	86.4	256.7	100.0
2	*Quercus dilatata* Lindl.	3	6.7	0.3	6.7	30.0	23.1	13.6	43.3	30.0

Table 2.3.5 Phytosociological attributes of Gumrush, Site Five, Winter Season Chakesar Valley, Shangla.

				Community Attributes						
	Herbaceous Layer	No	Ra	D	RD	F	RF	RCC	IV	Constancy
1	*Cynodon dactylon* (L.) Pers.	127	45.2	12.7	45.2	100.0	45.5	43.5	134.2	100.0
2	*Cenchrus ciliaris* L.	59	21.0	5.9	21.0	60.0	27.3	19.0	67.3	60.0
3	*Chrysopogon aucheri* (Boiss.) Stapf	95	33.8	9.5	33.8	60.0	27.3	37.0	98.1	60.0
Shruby layer										
1	*Indigofera hetrantha* Wall.	141	58.8	14.1	58.8	90.0	60.0	65.0	183.8	90.0
2	*Berberis lycium* Royle.	99	41.3	9.9	41.3	60.0	40.0	35.0	116.3	60.0
Tree layer										
1	*Pinus wallichiana* A. B. Jackson.	42	93.3	4.2	93.3	100.0	76.9	77.5	247.8	100.0
2	*Quercus dilatata* Lindl.	3	6.7	0.3	6.7	30.0	23.1	22.5	52.2	30.0

Table 2.4 Physiochemical analysis of Soil of Gumrush Hills, Chakesar, District Shangla.

No	Sites	Altitude	Soil Temperature	Location	Habitat	soil of Texture	Soil pH	EC	Ex. Na	Organic matter	Nitrogen %	P (%)	Ex. K (%)
1	Shabavera	1250	28	S	Moist	Sandy loam	7	0.06	0.3	0.96	0.06	15	50
2	Totash	1350	32	E	Moist	Sandy clayey loam	7.7	0.09	0.3	1.83	0.114	5	90
3	Totash dehri	1400	29	E	Dry	Loamy sand	6.1	0.26	0.4	1.48	0.093	76	850
4	Gumrush	1450	28	S	Dry	Sandy	6.6	0.11	0.3	0.45	0.028	7	80
5	Manga	1550	31	N	Moist	Sandy loam	7.7	0.32	0.2	1.94	0.121	10	260
6	White sar	1750	29	W	Dry	Sandy loam	7.8	0.11	0.2	1.82	0.114	10	50

Table 2.5 Environmental variables of Gumrush hills, Chakesar valley, District Shangla.

Stands	Locations	Altitude	Temperature(F)	PAR Light (µM/mΛ2S)	Leaf wetness (LW)	Solar rad (Wat/m2)	RH (%)	WND (Deg)	WNS (mph)
1	Shabavera	1250M	92.3	775	14	1040	56.7	31	10
2	Totash	1350M	92	770	15	1420	59.5	42	4
3	Totash dehri	1450M	90.3	680	0	1420	61.2	55	7
4	Manga	1550M	87.8	547	14	1505	56.3	245	2
5	Gumrush Dheri	1750M	86.4	664	12	1325	57.7	125	6

Table 2.6 . Comparative indices of similarities between different seasons of Gumrush Hills Chakesar Valley, District Shangla.

Spring Aspect					
	1	2	3	4	5
1	0				
2	97	0			
3	50	81	0		
4	34	44	65	0	
5	23	76	62	38	0

Summer Aspect					
	1	2	3	4	5
1	0				
2	35	0			
3	47	56	0		
4	38	32	34	0	
5	48	25	45	56	0

Winter Aspect					
	1	2	3	4	5
1	0				
2	57	0			
3	24	35	0		
4	14	29	24	0	
5	14	29	35	71	0

Table.2.7 Communities attributes of Gumrush Hill Chakesar, District Shangla.

Site	Aspect	Stand	No	Sp. Richness	Diversity	MI	E
GumrushHill	Spring	1	17	0.537	2.021	38.2	0.25
		2	15	0.46	1.546	37.3	0.16
		3	15	0.536	1.779	49.3	0.21
		4	17	0.43	1.7	57.3	0.23
		5	16	0.737	1.9	41.2	0.24
	Summer	1	30	0.857	2.3	23.7	0.24
		2	22	0.553	1.85	38.6	0.2
		3	16	0.66	4.483	38.1	0.54
		4	29	0.703	2.13	35.9	0.22
		5	26	0.632	2.3	35.8	0.26
	Winter	1	7	0.401	1.25	54.3	0.11
		2	8	0.405	1.8	23.8	0.28
		3	10	0.35	1.7	48	0.23
		4	8	0.274	1.81	62.5	0.29
		5	7	0.294	1.5	58.6	0.21

Table 2.8 Degree of homogeneity of Gumrush Hills, Chakesar Valley, District Shangla.

Stand	Spring	Summer	Winter
1	A >B > C > D >E	A ≥ B < C > D < E	A< B > C ≤ ≥ D > E
2	A < B > C ≤ ≥ D > E	A > B < C > D ≤ ≥ E	A<B < C > D < E
3	A < B > C < D > E	A < B > C < D > E	A < B > C < D > E
4	A > B < C > D ≤ ≥ E	A >B > C > D >E	A > B < C > D ≤ ≥ E
5	A < B > C ≤ ≥ D > E	A< B > C ≤ ≥ D > E	A ≥ B < C > D < E

Table 2.9.1. Regeneration Capacity of Spring Flora of Gumrush Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Ailanthus altissima* (Miller) Swingle	1	4						
2	*Ficus palmata* Forssk.		1						
3	*Juglan regia* L.	1							
4	*Melia azadarichta* Linn.		2						
5	*Morus nigra* L.		4						
6	*Olea ferruginea* Royle.		3						
7	*Pinus wallichiana* A. B. Jackson.	17	8	2	1				
8	*Pyrus pashia* Ham.	2	3						
9	*Quercus baloot* Griff., Itin. Not.	4	11	2	2	1			
10	*Salix tetrasperma* Roxb. Pl. Corom.		2						

Table 2.9.2 Regeneration Capacity of Summer Flora of Gumrush Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Acacia nilotica* (L.) Delile	1							
2	*Ailanthus altissima* (Miller) Swingle	8	6						
3	*Celtis australis* Wild.		5	4	1				
4	*Diospyrus kaki* Linn.		3						
5	*Diospyrus lotus* Linn.		3						
6	*Ficus palmata* Forssk.	2							
7	*Morus alba* Linn.			3	1				
8	*Platanus orientalis* Linn.				1				
9	*Pinus roxburghii* Sargent.	1	1						
10	*Pinus wallichiana* A. B. Jackson.	16	3						
11	*Pyrus pashia* Ham.	2							
12	*Quercus dilatata* Lindl.	6	8	3					
13	*Quercus incana* Roxb.	3	3	1					
14	*Salix babylonica* L.							1	

Table 2.9.2 Regeneration Capacity of Winter Flora of Gumrush Site, Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Ailanthus altissima* (Miller) Swingle	1	6						
2	*Diospyrus kaki* Linn.		3						
3	*Morus alba* Linn.		1	1					
4	*Pinus roxburghii* Sargent.	65			30	45		37	
5	*Pinus wallichiana* A. B. Jackson.	5	4	7	5	3	5	3	5
6	*Pyrus pashia* Ham.	1	3						
7	*Quercus dilatata* Lindl.	126	29	15		41	38	1	47

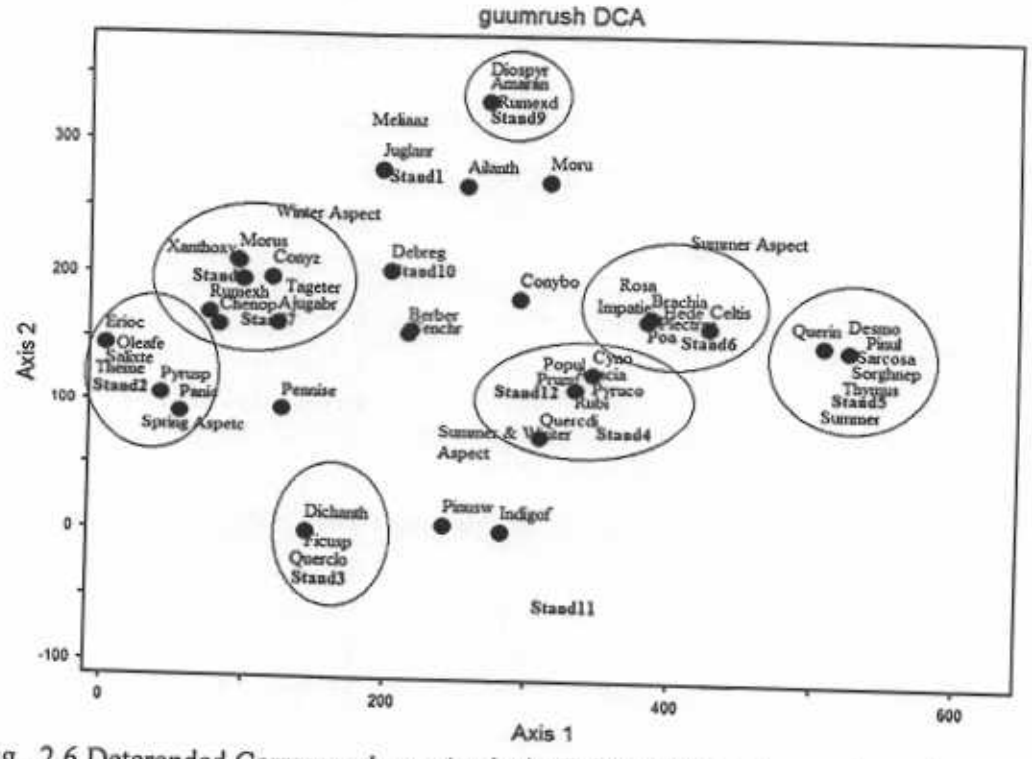


Fig. 2.6 Deterended Correspondence Analysis (DCA) of importance values of stands in Gumrush Hills, Chakesar Valley, Shangla.

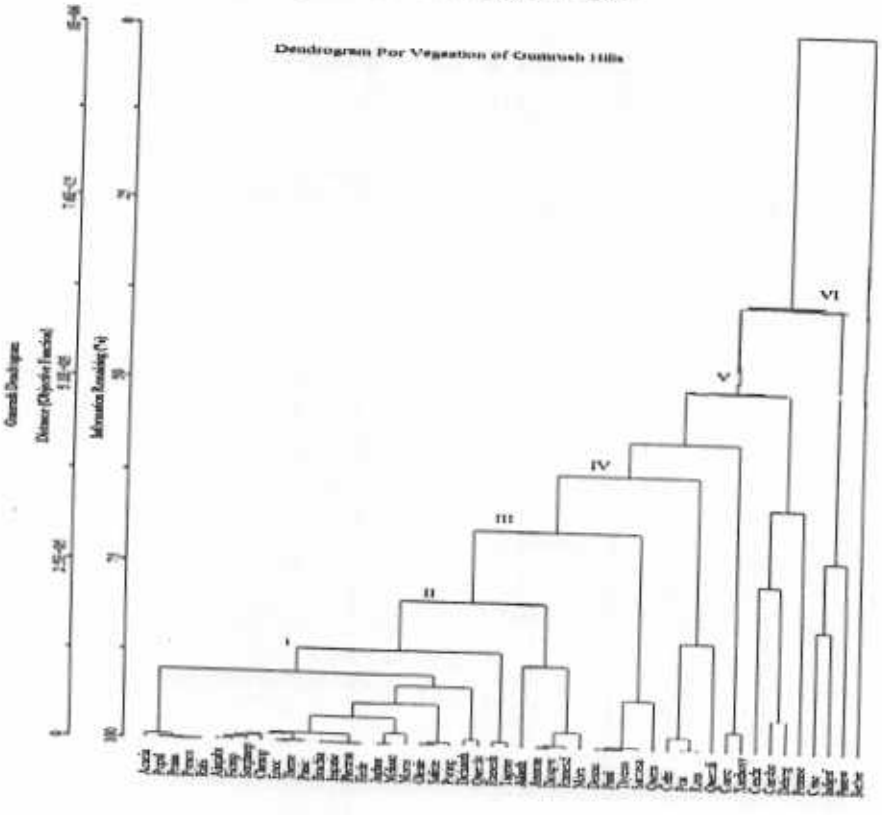


Fig. 2.7 Two way cluster dendrogram of species importance values in their stands in different aspect of the year.

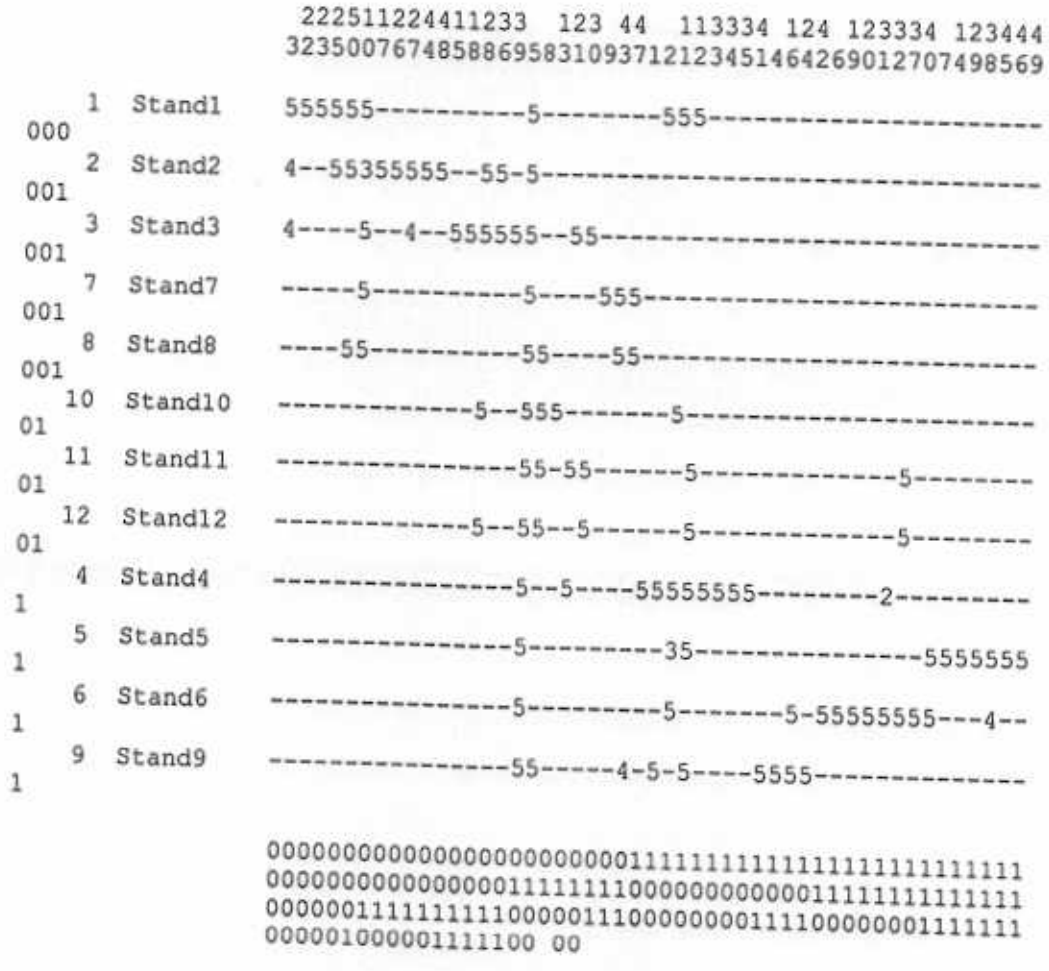


Fig. 2.8 Two way indicator species analysis (TWINSPAN) of Gumrush site.

Table 3.1.1. Phytosociological attributes of Dhanakol, Site One, Spring Season Chakesar Valley, Shangla.

	Name of Species		Community Attributes						
No	**Herbaceous Layer**	No	D	R.D	F	R.F	RCC	IV	Constancy
1	*Poa annua* L.	315	31.5	27.8	90.0	14.8	18.9	61.5	90
2	*Saccharum spontanum* L.	40	4.0	3.5	50.0	8.2	9.6	21.3	50
3	*Sonchus arvensis* (DC) Kirp.	8	0.8	0.7	30.0	4.9	2.0	7.6	30
4	*Conyza aegyptiaca* L.	21	2.1	1.9	40.0	6.6	2.6	11.0	40
5	*Cynodon dactylon* (L.) Pers.	366	36.6	32.3	80.0	13.1	18.2	63.6	80
6	*Oxalis corniculata* Linn.	89	8.9	7.9	60.0	9.8	7.2	24.9	60
7	*Conyza bonariansis* (Linn.) Cronquist	35	3.5	3.1	60.0	9.8	6.8	19.7	60
8	*Polygonum plebejum* R. Br.	27	2.7	2.4	30.0	4.9	5.2	12.5	30
9	*Rumex hastatus* D. Don..	59	5.9	5.2	30.0	4.9	2.0	12.1	30
10	*Juncus* species	27	2.7	2.4	20.0	3.3	1.3	7.0	20
11	*Cannabis sativa* Linn.	95	9.5	8.4	50.0	8.2	13.0	29.6	50
12	*Adiantum incisum* Forsk.	19	1.9	1.7	20.0	3.3	7.0	12.0	20
13	*Pteridium eqilinium* L.	32	3.2	2.8	50.0	8.2	6.4	17.4	50
Shrubby Layer									
1	*Rubus fruticosus* L.	121	12.1	30.3	70.0	36.8	24.3	91.4	70
2	*Berberis lycium* Royle.	124	12.4	31.0	50.0	26.3	44.3	101.6	50
3	*Debregetia salisifolia* (D. Don) Renle.	155	15.5	38.8	70.0	36.8	31.4	107.0	70
Tree Layer									
1	*Ailanthus altissima* (Miller) Swingle	6	0.6	75.0	20.0	66.7	30.1	171.8	20
2	*Morus alba* Linn.	2	0.2	25.0	10.0	33.3	70.0	128.3	10

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value.

Table 3.1.2. Phytosociological attributes of Dhanakol, Site Two, Spring Season Chakesar Valley, Shangla.

				Community Attributes						
No	**Species**	No	%	D	RD	F	RF	RCC	IV	constancy
1	*Impatiens edgeworthii* Hk. F.	47	8.1	4.7	8.1	50.0	11.6	6.3	26.0	50
2	*Poa annua* L.	159	27.5	15.9	27.5	70.0	16.3	16.9	60.7	70
3	*Rumex hastatus* D. Don..	44	7.6	4.4	7.6	30.0	7.0	5.0	19.6	30
4	*Artemisia dubia* Wall.	107	18.5	10.7	18.5	40.0	9.3	23.0	50.7	40
5	*Ajuga bracteosa* Wallich ex Benth.	15	2.6	1.5	2.6	40.0	9.3	2.5	14.4	40
6	*Juncus*	37	6.4	3.7	6.4	30.0	7.0	1.9	15.2	30
7	*Lepidium sativum* Linn.	8	1.4	0.8	1.4	30.0	7.0	1.9	10.2	30
8	*Cannabis sativa* Linn.	101	17.4	10.1	17.4	50.0	11.6	24.3	53.4	50
9	*Salvia moorcroftiana* Wall.	4	0.7	0.4	0.7	30.0	7.0	11.3	19.0	30
10	*Conyza aegyptiaca* L.	33	5.7	3.3	5.7	20.0	4.7	4.4	14.7	20
11	*Tagetes erecta* Linn.	22	3.8	2.2	3.8	20.0	4.7	1.3	9.7	20
12	*Salvia nubicola* Wall.	2	0.3	0.2	0.3	20.0	4.7	1.3	6.2	20
Shrubby layer										
1	*Dodonea viscose*	83	36.9	8.3	36.9	70.0	38.9	40.6	116.4	70
2	*Indigofera hetrantha* Wall.	77	34.2	7.7	34.2	70.0	38.9	34.7	107.8	70
3	*Plectranthus rugosus* Wall. ex Benth.	65	28.9	6.5	28.9	40.0	22.2	24.7	75.8	40
Tree layer										
1	*Pinus wallichiana* A. B. Jackson.	5	22.7	0.5	22.7	30.0	33.3	38.6	94.6	30
2	*Ailanthus altissima* (Miller) Swingle	15	68.2	1.5	68.2	50.0	55.6	38.6	162.3	50
3	*Diospyrus kaki* Linn.	2	9.1	0.2	9.1	10.0	11.1	22.6	42.8	10

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value.

Table 3.1.3. Phytosociological attributes of Dhanakol, Site Three, Spring Season Chakesar Valley, Shangla.

				Community Attributes						
No	Species	No	%	D	RD	F	RF	RCC	IV	Constancy
1	*Cannabis sativa* Linn.	120	27.5	12.0	27.5	40.0	11.1	23.9	62.5	40
2	*Conyza bonariansis* (Linn.) Cronquist	139	31.8	13.9	31.8	70.0	19.4	29.3	80.5	70
3	*Scripus* spp.	16	3.7	1.6	3.7	20.0	5.6	1.3	10.5	20
4	*Cyperus rotundus*	6	1.4	0.6	1.4	30.0	8.3	2.0	11.7	30
5	*Juncus* spp.	26	5.9	2.6	5.9	40.0	11.1	2.6	19.7	40
6	*Plantigo ovata* Forssk.	1	0.2	0.1	0.2	10.0	2.8	0.7	3.7	10
7	*Impatiens edgeworthii* Hk. F.	20	4.6	2.0	4.6	30.0	8.3	14.3	27.2	30
8	*Mentha viridis* Linn.	25	5.7	2.5	5.7	10.0	2.8	9.7	18.2	10
9	*Cynodon dactylon* (L.) Pers.	52	11.9	5.2	11.9	30.0	8.3	11.0	31.2	30
10	*Oxalis corniculata* Linn.	5	1.1	0.5	1.1	20.0	5.6	1.4	8.1	20
11	*Brachiaria reptens* (L.) Stapf.	14	3.2	1.4	3.2	30.0	8.3	2.0	13.5	30
12	*Trifolium repense* Linn.	5	1.1	0.5	1.1	10.0	2.8	0.7	4.6	10
13	*Poa annua* L.	8	1.8	0.8	1.8	20.0	5.6	1.3	8.7	20
Shrubby layer										
1	*Plectranthus rugosus* Wall. ex Benth.	171	47.2	17.1	47.2	80.0	33.3	36.1	116.7	80
2	*Berberis lycium* Royle.	97	26.8	9.7	26.8	60.0	25.0	30.4	82.2	60
3	*Indigofera hetrantha* Wall.	77	21.3	7.7	21.3	50.0	20.8	28.8	70.9	50
4	*Desmodium elegans* DC.	17	4.7	1.7	4.7	50.0	20.8	4.8	30.3	50
Tree layer										
1	*Ailanthus altissima* (Miller) Swingle	17	85.0	1.7	85.0	50.0	62.5	30.2	177.7	50
2	*Platanus orientalis* Linn.	1	5.0	0.1	5.0	10.0	12.5	21.5	39.0	10
3	*Ficus palmata* Forssk.	1	5.0	0.1	5.0	10.0	12.5	20.1	37.6	10

4	*Pyrus communis* Linn.	1	5.0	0.1	5.0	10.0	12.5	28.1	45.6	10

Table 3.1.4. Phytosociological attributes of Dhanakol, Site Four, Spring Season Chakesar Valley, Shangla.

	Name of the specie			Community Attributes						
No	**Herbaceous layer**	No	%	D	RD	F	RF	RCC	IV	Constancy
1	*Artemisia dubia* Wall.	891	69.7	89.1	69.7	80.0	25.8	39.6	135.1	80
2	*Tagetes erecta* Linn.	82	6.4	8.2	6.4	60.0	19.4	4.1	29.9	60
3	*Oxalis corniculata* Linn.	142	11.1	14.2	11.1	60.0	19.4	14.9	45.4	60
4	*Impatiens edgeworthii* Hk. F.	57	4.5	5.7	4.5	50.0	16.1	21.3	41.9	50
5	*Brachiaria reptens* (L.) Stapf.	38	3.0	3.8	3.0	30.0	9.7	4.9	17.5	30
6	*Mentha viridis* Linn.	25	2.0	2.5	2.0	10.0	3.2	5.5	10.7	10
7	*Conyza bonariansis* (Linn.) Cronquist	44	3.4	4.4	3.4	20.0	6.5	9.7	19.6	20
Shrubby layer										
1	*Plectranthus rugosus* Wall. ex Benth.	460	97.3	46.0	97.3	70.0	77.8	84.7	259.7	70
2	*Rubus ellipticus* Smith.	13	2.7	1.3	2.7	20.0	22.2	15.3	40.3	20
Tree layer										
1	*Alnus nitida* (Spach) Endl.	5	14.7	0.5	14.7	20.0	12.5	11.1	38.3	20
2	*Salix babylonica* L.	6	17.6	0.6	17.6	30.0	18.8	29.9	66.3	30
3	*Ficus palmata* Forssk.	10	29.4	1.0	29.4	40.0	25.0	8.4	62.8	40
4	*Morus nigra* L.	1	2.9	0.1	2.9	10.0	6.3	27.8	37.0	10
5	*Ailanthus altissima* (Miller) Swingle	10	29.4	1.0	29.4	40.0	25.0	8.5	62.9	40
6	*Melia azadarichta* Linn.	1	2.9	0.1	2.9	10.0	6.3	8.0	17.2	10
7	*Diospyrus kaki* Linn.	1	2.9	0.1	2.9	10.0	6.3	6.3	15.5	10

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value.

Table 3.2.1. Phytosociological attributes of Dhanakol, Site One, Summer Season Chakesar Valley, Shangla.

	Name of Plants		Community Attributes						
S.No	**Herbaceous Layer**	No	Density	R.Density	Frequency	R.Freq.	RCC	IV	Constancy
1	*Oxalis corymbosa* DC.	17	1.7	1.5	20.0	4.1	1.7	7.3	20
2	*Euphorbia hirta* L.	2	0.2	0.2	10.0	2.0	0.3	2.5	10
3	*Oenthra rosea*	12	1.2	1.1	20.0	4.1	2.0	7.2	20
4	*Cynodon dactylon* (L.) Pers.	110	11	9.9	10.0	2.0	4.3	16.2	10
5	*Lepidium sativum* Linn.	2	0.2	0.2	10.0	2.0	0.3	2.5	10
6	*Amaranthus viridis* L.	2	0.2	0.2	10.0	2.0	0.3	2.5	10
7	*Dicliptra roxburghiana* Juss.	345	34.5	31.2	60.0	12.2	19.1	62.5	60
8	*Origanum vulgare* Linn.	10	1	0.9	10.0	2.0	0.3	3.2	10
9	*Cannabis sativa* Linn.	279	27.9	25.2	90.0	18.4	32.8	76.4	90
10	*Oxalis pes-capre* Linn.	21	2.1	1.9	20.0	4.1	3.4	9.4	20
11	*Geranium wallichianum* D. Don.	15	1.5	1.4	10.0	2.0	1.7	5.1	10
12	*Bromus japonica* Thunb.	62	6.2	5.6	40.0	8.2	2.6	16.4	40
13	*Conyza bonariansis* (Linn.) Cronquist	1	0.1	0.1	10.0	2.0	0.3	2.4	10
14	*Dactylis glomerata* L.	19	1.9	1.7	30.0	6.1	0.9	8.7	30
15	*Convolulus arvensis* L.	6	0.6	0.5	40.0	8.2	1.1	9.9	40
16	*Avena sativa* L.	1	0.1	0.1	10.0	2.0	0.3	2.4	10
17	*Senecio chrysanthemoides* DC.	13	1.3	1.2	20.0	4.1	0.6	5.8	20
18	*Stachys emodi* Hedge	19	1.9	1.7	20.0	4.1	8.5	14.3	20
19	*Impatiens edgeworthii* Hk. F.	16	1.6	1.4	10.0	2.0	1.7	5.2	10
20	*Brachiaria reptens* (L.) Stapf.	155	15.5	14.0	40.0	8.2	17.8	40.0	40
Shrubby Layer									
1	*Zanthoxylum armatum* DC.	4	0.4	2.9	30.0	18.8	18.3	39.9	30
2	*Rubus fruticosus* L.	64	6.4	45.7	30.0	18.8	30.8	95.2	30
3	*Indigofera hetrantha* Wall.	28	2.8	20.0	60.0	37.5	30.8	88.3	60

4	*Berberis lycium* Royle.	44	4.4	31.4	40.0	25.0	20.2	76.6	40
Tree layer									
1	*Ailanthus altissima* (Miller) Swingle	15	1.5	48.4	40.0	30.8	1.7	80.9	40
2	*Melia azadarichta* Linn.	10	1	32.3	40.0	30.8	25.5	88.5	40
3	*Ficus palmata* Forssk.	3	0.3	9.7	30.0	23.1	15.8	48.6	30
4	*Pyrus communis* Linn.	2	0.2	6.5	10.0	7.7	43.9	58.0	10
5	*Pinus roxburghii* Sargent.	1	0.1	3.2	10.0	7.7	13.1	24.0	10

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value.

Table 3.2.2. Phytosociological attributes of Dhanakol, Site Two, Summer Season Chakesar Valley, Shangla.

	Name of the specie		Community Attributes						
S.No	**Herbaceous layer**	No	D	RD	F	RF	RCC	IV	Constancy
1	*Cynodon dactylon* (L.) Pers.	401	40.1	44.0	90.0	14.8	47.5	106.3	90
2	*Eragrostis japonica* (Thunb.) Trin.	48	4.8	5.3	30.0	4.9	3.6	13.7	30
3	Oenthra rosea	20	2	2.2	40.0	6.6	1.1	9.8	40
4	*Oxalis corniculata* Linn.	134	13.4	14.7	60.0	9.8	9.5	34.1	60
5	*Plantigo major* Linn.	7	0.7	0.8	30.0	4.9	4.4	10.1	30
6	*Duchesnia indica* forsk.	18	1.8	2.0	50.0	8.2	1.6	11.8	50
7	*Geranium wallichianum* D. Don.	16	1.6	1.8	40.0	6.6	1.1	9.4	40
8	*Micromaria biflora* (Ham.) Benth.	15	1.5	1.6	20.0	3.3	0.5	5.5	20
9	*Megacodon stylophorus* (C. B. Clarke)	39	3.9	4.3	40.0	6.6	3.8	14.7	40
10	*Dicliptra bupleuroides* Nees	6	0.6	0.7	20.0	3.3	0.5	4.5	20
11	*Rumex hastatus* D. Don..	53	5.3	5.8	50.0	8.2	13.1	27.2	50
12	*Conyza aegyptiaca* L.	41	4.1	4.5	40.0	6.6	2.5	13.5	40
13	*Cyperus rotundus* L.	48	4.8	5.3	30.0	4.9	0.8	11.0	30
14	*Convolulus arvensis* L.	4	0.4	0.4	10.0	1.6	0.3	2.4	10

15	*Saccharum munja* Roxb.	52	5.2	5.7	40.0	6.6	6.2	18.5	40
16	*Artemisia dubia* Wall.	10	1	1.1	20.0	3.3	3.3	7.7	20
Shrubby Layer									
1	*Rubus fruticosus* L.	28	2.8	4.5	30.0	8.8	6.7	19.9	30
2	*Berberis lycium* Royle.	236	23.6	37.6	90.0	26.5	24.9	89.0	90
3	*Thymus serphylum* Benth.	242	24.2	38.5	80.0	23.5	36.5	98.5	80
4	*Indigofera hetrantha* Wall.	100	10	15.9	60.0	17.6	21.3	54.9	60
5	*Desmodium elegans* DC.	16	1.6	2.5	60.0	17.6	2.4	22.6	60
6	*Rosa macrophylla* Lindl.	6	0.6	1.0	20.0	5.9	8.2	15.1	20
Tree layer									
1	*Platanus orientalis* Linn.	1	0.1	25.0	10.0	25.0	25.0	75.0	10
2	*Celtis australis* Wild.	1	0.1	25.0	10.0	25.0	25.0	75.0	10
3	*Ficus palmata* Forssk.	1	0.1	25.0	10.0	25.0	25.0	75.0	10
4	*Pyrus communis* Linn.	1	0.1	25.0	10.0	25.0	25.0	75.0	10

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value.

Table 3.2.3. Phytosociological attributes of Dhanakol, Site Three, Summer Season Chakesar Valley, Shangla.

	Name of Plants		Community Attributes						
S.No	**Herbaceous Layer**	No	Density	R.Density	F	R.F	RCC	IV	Constancy
1	*Brachiaria reptens* (L.) Stapf.	283	28.3	30.3	50.0	19.4	15.5	65.2	50
2	*Sonchus arvensis* (DC) Kirp.	1	0.1	0.1	10.0	3.9	0.3	4.3	10
3	*Chenopodium album* Linn.	5	0.5	0.5	10.0	3.9	0.3	4.7	10
4	*Cynodon dactylon* (L.) Pers.	100	10	10.7	10.0	3.9	12.6	27.2	10
5	*Dicliptra roxburghiana* Juss.	4	0.4	0.4	10.0	3.9	0.3	4.6	10
6	*Micromaria biflora* (Ham.) Benth.	10	1	1.1	10.0	3.9	0.3	5.3	10
7	*Cannabis sativa* Linn.	52	5.2	5.6	30.0	11.6	10.3	27.5	30
8	*Oenthera*	10	1	1.1	10.0	3.9	0.3	5.3	10
9	*Plantigo lanceolata* Linn.	1	0.1	0.1	10.0	3.9	0.3	4.3	10
10	*Verbascum thapsis* L.	1	0.1	0.1	10.0	3.9	1.9	5.9	10
11	*Rumex hastatus* D. Don..	60	6	6.4	10.0	3.9	11.0	21.3	10
12	*Lepidium sativum* Linn.	5	0.5	0.5	10.0	3.9	1.9	6.4	10
13	*Cyperus rotundus* L.	32	3.2	3.4	40.0	15.5	2.9	21.8	40
14	*Dianthus angulatus* Royle.	7	0.7	0.8	3.0	1.2	1.0	2.9	3
15	*Poa annua* L.	331	33.1	35.5	5.0	1.9	35.4	72.8	5
16	*Mentha longifolia* (L.) Hudson.	25	2.5	2.7	10.0	3.9	4.8	11.3	10
17	*Ajuga bracteosa* Wallich ex Benth.	6	0.6	0.6	20.0	7.8	0.6	9.0	20
Shruby layer									
1	*Rubus fruticosus* L.	71	7.1	11.8	50.0	21.7	14.2	47.8	50
2	*Indigofera hetrantha* Wall.	140	14	23.3	70.0	30.4	23.0	76.8	70
3	*Berberis kunawarensis* Royle.	198	19.8	33.0	60.0	26.1	31.0	90.1	60
4	*Thymus serphylum* Benth.	191	19.1	31.8	50.0	21.7	31.7	85.3	50
Tree layer									
1	*Pinus roxburghii* Sargent.	2	0.2	14.3	10.0	12.5	3.8	30.6	10

2	*Ficus palmata* Forssk.	3	0.3	21.4	30.0	37.5	44.2	103.1	30
3	*Ailanthus altissima* (Miller) Swingle	7	0.7	50.0	20.0	25.0	22.0	97.0	20
4	*Pisticia integrima* Stew ex. Brandis	2	0.2	14.3	20.0	25.0	30.0	69.3	20

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value.

Table 3.2.4. Phytosociological attributes of Dhanakol, Site Four, Summer Season Chakesar Valley, Shangla.

	Name of the specie		Community Attributes						
S.No	**Herbaceous layer**	No of Plants	D	RD	F	RF	RCC	IV	Constancy
1	*Cynodon dactylon* (L.) Pers.	100	10	16.6	20.0	4.8	17.2	38.5	20
2	*Lepidium sativum* Linn.	51	5.1	8.4	20.0	4.8	2.5	15.7	20
3	*Brachiaria reptens* (L.) Stapf.	2	0.2	0.3	10.0	2.4	0.4	3.1	10
4	*Conyza bonariansis* (Linn.) Cronquist	22	2.2	3.6	20.0	4.8	5.6	14.0	20
5	*Heliotropium strigosum* Willd.	3	0.3	0.5	20.0	4.8	0.7	6.0	20
6	*Rumex naphalensis* Sprengel	21	2.1	3.5	30.0	7.1	5.9	16.5	30
7	*Polygonum plebejum* R. Br.	4	0.4	0.7	10.0	2.4	0.4	3.4	10
8	*Stachys emodi* Hedge	20	2	3.3	20.0	4.8	2.5	10.5	20
9	*Imaptiens balsiminea* Linn.	131	13.1	21.7	60.0	14.3	31.2	67.2	60
10	*Oxalis corniculata* Linn.	28	2.8	4.6	40.0	9.5	6.3	20.4	40
11	*Rumex hastatus* D. Don..	35	3.5	5.8	40.0	9.5	4.9	20.2	40
12	*Pteris vitata* L.	25	2.5	4.1	40.0	9.5	4.9	18.6	40
13	*Artemisia vulgare* L.	90	9	14.9	40.0	9.5	11.1	35.5	40
14	*Plantigo major* Linn.	30	3	5.0	10.0	2.4	5.2	12.6	10
15	*Micromaria biflora* (Ham.) Benth.	3	0.3	0.5	10.0	2.4	0.4	3.2	10
16	*Galium aparine* Linn.	15	1.5	2.5	10.0	2.4	0.4	5.2	10
17	*Viola serpens* Wall. Ex Roxb.	24	2.4	4.0	20.0	4.8	0.7	9.4	20

Shrubby layer									
1	*Sarcococca saligna* (D.Don) Muell.	252	25.2	28.8	90.0	26.5	20.0	75.2	90
2	*Thymus serphylum* Benth.	52	5.2	5.9	60.0	17.6	11.7	35.3	60
3	*Berberis lycium* Royle.	225	22.5	25.7	70.0	20.6	29.2	75.5	70
4	*Indigofera hetrantha* Wall.	255	25.5	29.1	70.0	20.6	29.6	79.3	70
5	*Desmodium elegans* DC.	92	9.2	10.5	50.0	14.7	9.5	34.7	50
Tree Layer									
1	*Pinus wallichiana* A. B. Jackson.	13	1.3	50.0	40.0	36.4	35.6	122.0	40
2	*Pyrus pashia* Ham.	9	0.9	34.6	30.0	27.3	41.0	102.9	30
3	*Ficus palmata* Forssk.	4	0.4	15.4	40.0	36.4	23.4	75.2	40

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value.

Table 3.3.1 Phytosociological attributes of Dhanakol, Site One, Winter Season Chakesar Valley, Shangla.

	Name			Community Attributes						
No	Herbaceous Layer	No	%	D	RD	F	RF	RCC	IV	Con
1	*Tagetes erecta* Linn.	55	44.4	5.5	44.4	100.0	45.5	50.0	139.8	100
2	*Rumex hastatus* D. Don..	60	48.4	6.0	48.4	40.0	18.2	31.7	98.2	40
3	*Conyza bonariansis* (Linn.) Cronquist	5	4.0	0.5	4.0	40.0	18.2	13.3	35.5	40
4	*Ajuga bracteosa* Wallich ex Benth.	4	3.2	0.4	3.2	40.0	18.2	5.0	26.4	40
Shruby layer										
1	*Zanthoxylum armatum* DC.	10	18.9	1.0	18.9	40.0	40.0	20.0	78.9	40
2	*Berberis lycium* Royle.	43	81.1	4.3	81.1	60.0	60.0	80.0	221.1	60

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value.

Table 3.3.2 Phytosociological attributes of Dhanakol, Site Two, Winter Season Chakesar Valley, Shangla.

	Name			Community Attributes						
No	Herbaceous Layer	No	%	D	RD	F	RF	RCC	IV	Constancy
1	*Androsace rotundifolia* Hardw.	7	5.0	0.7	5.0	50.0	16.1	19.2	40.4	50
2	*Tagetes erecta* Linn.	49	35.3	4.9	35.3	100.0	32.3	134.6	202.1	100
3	*Pteridium eqilinium* L.	18	12.9	1.8	12.9	30.0	9.7	30.8	53.4	30
4	*Duchesnia indica* forsk.	8	5.8	0.8	5.8	40.0	12.9	19.2	37.9	40
5	*Artemisia japonica* Thunb., Fl. Jap.	4	2.9	0.4	2.9	30.0	9.7	11.5	24.1	30
6	*Rumex hastatus* D. Don..	53	38.1	5.3	38.1	60.0	19.4	100.0	157.5	60
Shrubby Layer										
1	*Berberis lycium* Royle.	73	100.0	7.3	100.0	100.0	100.0	100.0	300.0	100
Tree Layer										
1	*Pinus wallichiana A. B. Jackson.*	6	54.5	0.6	54.5	30.0	60.0	68.5	183.0	30
2	*Quercus semicarfifolia Sm.*	5	45.5	0.5	45.5	20.0	40.0	31.5	117.0	20

Key Words = D = Density, R.D = Relative Density, F = Frequency, R.F = Relative Frequency, RCC = Relative Frequency, IV = Importance Value.

Table 3.3.3 Phytosociological attributes of Dhanakol, Site Three, Winter Season Chakesar Valley, Shangla.

	Name			Community Attributes						
No	Herbaceous Layer	No	%	D	RD	F	RF	RCC	IV	Constancy
1	*Tagetes erecta* Linn.	165	83.3	16.5	83.3	100.0	52.6	54.1	190.1	100
2	*Pennisetum orientale* Rich.	7	3.5	0.7	3.5	30.0	15.8	2.3	21.7	30
3	*Rumex hastatus* D. Don..	18	9.1	1.8	9.1	20.0	10.5	40.4	60.1	20
4	*Conyza aegyptiaca* L.	8	4.0	0.8	4.0	40.0	21.1	3.1	28.2	40
Shruby Layer										
1	*Berberis lycium* Royle.	44	32.8	4.4	32.8	50.0	33.3	31.3	97.4	50
2	*Indigofera hetrantha* Wall.	45	33.6	4.5	33.6	80.0	53.3	32.5	119.4	80
3	*Plectranthus rugosus* Wall. ex Benth.	45	33.6	4.5	33.6	20.0	13.3	37.0	83.9	20
Tree Layer										
1	*Pinus wallichiana* A. B. Jackson.	6	75	0.6	75	30	60	80.3	215.3	30
2	*Quercus incana* Roxb.	2	25	0.2	25	20	40	10.7	75.7	20

Table 3.3.4 Phytosociological attributes of Dhanakol, Site Four, Winter Season Chakesar Valley, Shangla.

	Name			Community Attributes						
No	Herbaceous Layer	No	%	D	RD	F	RF	RCC	IV	Const.
1	*Dactylis glomerata* L.	104	52.79188	10.4	52.79188	100	41.66667	50.46904	144.9276	100
2	*Pennisetum orientale* Rich.	59	29.94924	5.9	29.94924	60	25	32.6454	87.59464	60
3	*Poa annua* L.	28	14.2132	2.8	14.2132	30	12.5	12.19512	38.90832	30
4	*Androsace rotundifolia* Hardw.	6	3.045685	0.6	3.045685	50	20.83333	4.690432	28.56945	50
Shruby Layer										
1	*Berberis lycium* Royle.	67	67.67677	6.7	67.67677	50	38.46154	70.5	176.6383	50
2	*Indigofera hetrantha* Wall.	32	32.32323	3.2	32.32323	80	61.53846	28.75	122.6117	80
Tree Layer										
1	*Pinus wallichiana* A. B. Jackson.	7	100	0.7	100	40	100	100	300	40

Table 3.4. Physiochemical analysis of Soil of Dhanakol Hills, Chakesar, District Shangla.

No	Sites	Altitude	Soil Temperature	Soil Color	Slope	Location	Habitat	SoilTexture	Soil pH	EC	Ex. Na	Organic matter	Nitrogen %	P (%)	Ex. K (%)
1	Khan China	1450m	34	Brown	20	W	Moist warm	Sandy loam	4.6	0.2	0.4	1.54	0.096	10	90
2	Peech lar	1550m	34	Brown	70	NW	Dry	Sandy loam	6.6	0.06	0.3	1.88	0.118	8	70
3	Saidan	1650m	33	Brown	65	W	Dry	Sandy loam	6.4	0.08	0.3	2.03	0.127	9	80
4	Khadang	1750m	31	Black	45	W	Moist	Sandy loam	7	0.08	0.2	0.61	0.038	6	70
5	Dhanakol sar	1850m	31	Black	52	E	Moist	Loamy sand	6.1	0.26	0.4	1.48	0.093	76	850

Table 3.5. Environmental variables of Dhanakol hills, Chakesar valley, District Shangla.

Stands	Locations	Altitude	Temperature(F)	PAR Light (µM/mΛ2S)	Leaf wetness (LW)	Solar rad (Wat/m2)	RH (%)	WND (Deg)	WNS (mph)
1	Khan China	1450m	94.5	690	13	1658	62.9	265	6
2	Peech lar	1550m	92.4	775	0	1450	56.2	237	2
3	Saidan	1650m	91.3	700	1	1438	55.1	217	3
4	Khadang	1750m	90.5	675	14	1227	52.9	227	8

Fig. 3.6. Comparative indices of similarities between different seasons of Dhanakol Hills Chakesar Valley, District Shangla.

Spring				
	A	B	C	D
A	0			
B	19	0		
C	22	22	0	
D	18	19	19	0

Summer				
	A	B	C	D
A	0			
B	29	0		
C	37	31	0	
D	33	35	32	0

Winter				
	A	B	C	D
A	0			
B	47	0		
C	35	44	0	
D	13	38	50	0

3.7. Communities attributes of Dhanakol Hill Chakesar, District Shangla.

		Stand	No	Sp. Richness	Diversity	MI	E
Dhanakol Hill	Spring	1	19	0.459	2.334	43.7	0.29
		2	18	0.626	2.451	33.3	0.31
		3	21	0.73	2.349	32.4	0.28
		4	16	0.378	1.5	35	0.15
	Summer	1	29	0.8	2.395	26.9	0.26
		2	26	0.7	2.4	38.1	0.27
		3	25	0.6	2.316	25.6	0.26
		4	25	0.644	2.581	35.2	0.29
	Winter	1	8	0.59	1.6	48.8	0.23
		2	9	0.602	1.7	43.3	0.24
		3	9	0.402	1.6	48.9	0.21
		4	7	0.488	1.6	55.7	0.24

Fig. 3.8. Degree of homogeneity of Dhanakol Hills, Chakesar Valley, District Shangla.

Stand No	Spring	Summer	Winter
1	A = B < C > D > E	A > B > C > D < E	A < B > C ≤ ≥ D < E
2	A < B > C = D > E	A < B > C > D < E	A > B > C < D > E
3	A > B > C > D > E	A > B > C > D > E	A > B < C > D ≤ ≥ E
4	A > B > C > D > E	A > B > C ≤ ≥ D > E	A < B > C > D < E

Fig. 3.9.1. Regeneration Capacity of Spring Flora of Dhanakol Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Ailanthus altissima* (Miller) Swingle	7	7		2				
	Alnus nitida (Spach) Endl.		1	1					
	Diospyrus kaki Linn.		2						
2	*Ficus palmata* Forssk.	2	1	1	1				
3	*Melia azadarichta* Linn.		1						
4	*Morus alba* Linn.		1						
5	*Morus nigra* L.				1				
6	*Pinus wallichiana* A. B. Jackson.	2	3	1	1				
7	*Platanus orientalis* Linn.		1						
8	*Pyrus communis* Linn.		1						
9	*Salix tetrasperma* Roxb. Pl. Corom.			1	1		1		

Fig. 3.9.3. Regeneration Capacity of Summer Flora of Dhanakol Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Ailanthus altissima* (Miller) Swingle	4	1	1					
2	*Celtis australis* Wild.		1						
3	*Ficus palmata* Forssk.	1	6	2	2				
4	*Melia azadarichta* Linn.	1	2		1				
5	*Pinus roxburghii* Sargent.	1	1						
6	*Pinus wallichiana* A. B. Jackson.	2	1		1				
7	*Pisticia integrima* Stew ex. Brandis			1	1				
8	*Platanus orientalis* Linn.		1						
9	*Pyrus communis* Linn.		1		1				
10	*Pyrus pashia* Ham.		2	1					

Fig. 3.9.3. Regeneration Capacity of Winter Flora of Dhanakol Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Platanus orientalis* Linn.			1			1		
2	*Pinus wallichiana* A. B. Jackson.	4		2	1	1	1		
3	*Ficus palmata* Forssk.	2	3	4	2	1			
4	*Ailanthus altissima* (Miller) Swingle	1		1		1			

```
                 11 12 2   111222 111223 23 1223
                30184314679237258556807149029162

 4  Stand4      54--555-2----5-----------------  000
 7  Stand7      ------55-5--4----55-5255--------  000
 1  Stand1      ------5525---5--52------4-------  001
 2  Stand2      5555-555---------54----------5--  001
 3  Stand3      ---4555355--5355-55-----5-------  001
 5  Stand5      ------3--4-55--5555525--5------5  01
 6  Stand6      ---------45455555------555------  01
 8  Stand8      5-------455-52----5-2---52---5--  01
 9  Stand9      --------5---5----------555---55  1
10  Stand10     ------------------------5555-55-  1
11  Stand11     -----5-----------5-----555-55--  1
12  Stand12     -------5----------5-----5--555--  1

                00000000000000000000000011111111
                00000000111111111111111100000011
                00000011000000000111111000111
                000111  000 00
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Fig. 3.10. Two way indicator species analysis (TWINSPAN) of Dhanakol site.

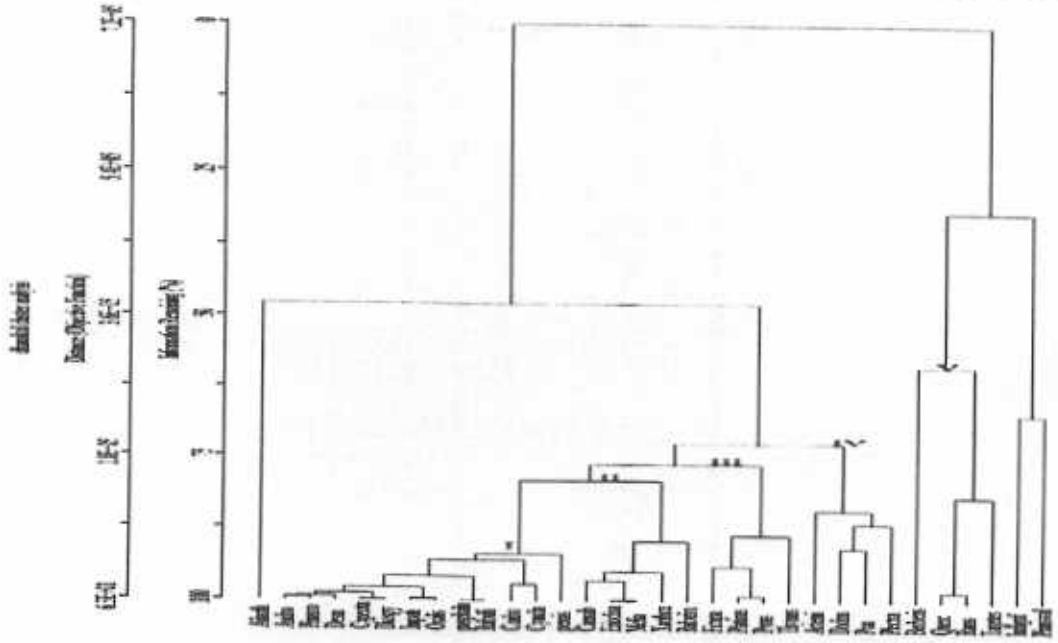


Fig . 3.11. Two way cluster dendrogram of species importance values in their stands in different aspect of the year.

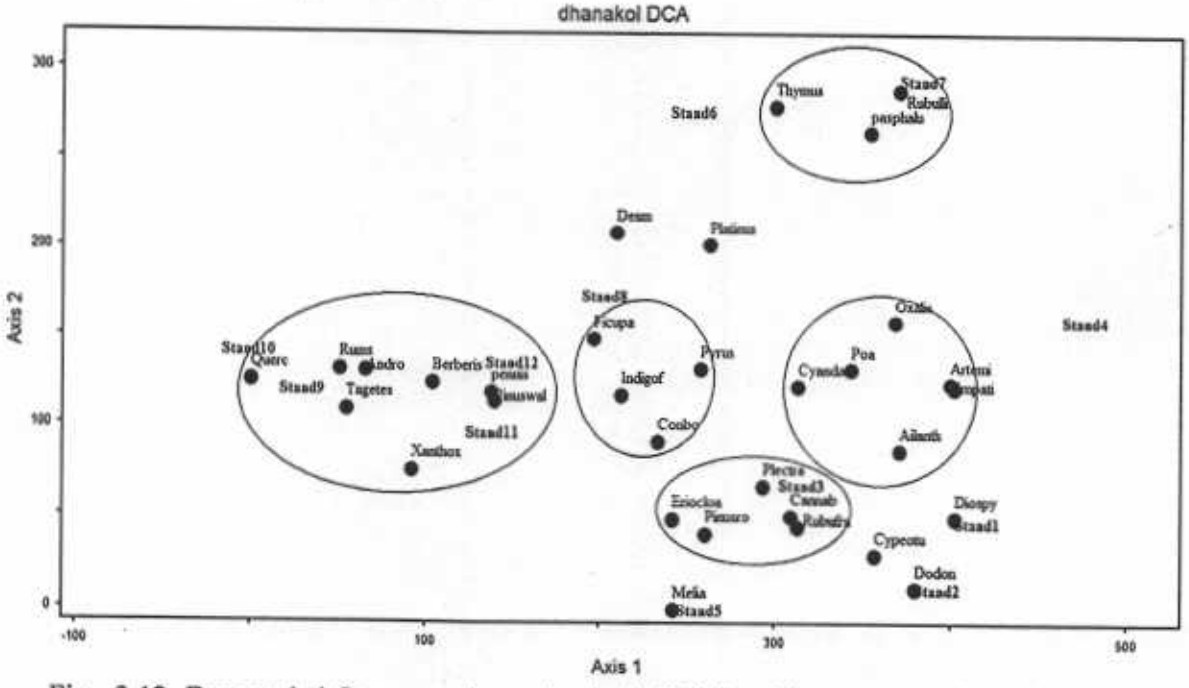


Fig. 3.12. Deterended Correspondence Analysis (DCA) of importance values of stands in Dhanakol Hills, Chakesar Valley, Shangla.

Table 4.1.1. Phytosociological attributes of Bakht Banda, Site One, Spring Season Chakesar Valley, Shangla.

	Name of Plants			Community Attributes						
S.No	**Herbaceous Layer**	No	%	Density	R.Density	Frequency	R.Freq.	RCC	IV	Constancy
1	*Artemisia vulgare* L.	27	9.7	2.7	9.7	30.0	8.6	10.6	28.8	30
2	*Poa annua* L.	69	24.7	6.9	24.7	40.0	11.4	7.3	43.5	40
3	*Oxalis corniculata* Linn.	19	6.8	1.9	6.8	40.0	11.4	2.4	20.7	40
4	*Xanthium strumarium* Linn	5	1.8	0.5	1.8	10.0	2.9	0.8	5.5	10
5	*Arisaema flavum* (Forssk.) Schott.	3	1.1	0.3	1.1	30.0	8.6	2.4	12.1	30
6	*Speen gulay*	37	13.3	3.7	13.3	30.0	8.6	14.7	36.5	30
7	*Plantigo lanceolata* Linn.	4	1.4	0.4	1.4	40.0	11.4	3.3	16.1	40
8	*Aconitum violata* Jacque. Staff.	2	0.7	0.2	0.7	20.0	5.7	1.6	8.1	20
9	*Mentha arvensis* L.	57	20.4	5.7	20.4	30.0	8.6	21.9	50.9	30
10	*Trifolium repense* Linn.	18	6.5	1.8	6.5	30.0	8.6	10.6	25.6	30
11	*Urtica dioica* Linn.	14	5.0	1.4	5.0	20.0	5.7	2.4	13.2	20
12	*Polygonum aviculare* Linn.	24	8.6	2.4	8.6	30.0	8.6	21.9	39.0	30
Shrubby layer										
1	*Plectranthus rugosus* Wall. ex Benth.	177	66.8	17.7	66.8	70.0	41.2	66.0	173.9	70
2	*Indigofera hetrantha* Wall.	57	21.5	5.7	21.5	50.0	29.4	29.7	80.6	50
3	*Vibernum grandiflorum* Wall. Ex DC.	3	1.1	0.3	1.1	20.0	11.8	1.8	14.7	20
4	*Sarcococca saligna* (D.Don) Muell.	28	10.6	2.8	10.6	30.0	17.6	2.6	30.8	30
Tree Layer										
1	*Pinus wallichiana* A. B. Jackson.	45	70.3	4.5	70.3	100.0	50.0	75.2	195.5	100
2	*Quercus dilatata* Lindl.	4	6.3	0.4	6.3	30.0	15.0	14.4	35.7	30
3	*Hedra helix* L.	6	9.4	0.6	9.4	30.0	15.0	2.1	26.5	30
4	*Ailanthus altissima* (Miller) Swingle	9	14.1	0.9	14.1	40.0	20.0	8.3	42.4	40

Table 4.1. 2 Phytosociological attributes of Bakht Banda, Site Two, Spring Season Chakesar Valley, Shangla.

	Name of the specie			Community Attributes						
S.No	**Herbaceous layer**	No	%	D	RD	F	RF	RCC	IV	constancy
1	*Artemisia vulgare* L.	82	22.6	8.2	22.6	80.0	24.2	16.7	63.5	80
2	*Rumex dentatus* Linn.	10	2.8	1.0	2.8	30.0	9.1	10.3	22.1	30
3	*Bromus japonica* Thunb.	147	40.5	14.7	40.5	50.0	15.2	32.1	87.7	50
4	*Polygonum aviculare* Linn.	7	1.9	0.7	1.9	20.0	6.1	2.6	10.6	20
5	*Plantigo lanceolata* Linn.	3	0.8	0.3	0.8	30.0	9.1	3.8	13.8	30
6	*Xanthium strumarium* Linn	1	0.3	0.1	0.3	10.0	3.0	7.7	11.0	10
7	*Brachiaria reptens* (L.) Stapf.	40	11.0	4.0	11.0	50.0	15.2	12.8	39.0	50
8	*Viola biflora*L.	18	5.0	1.8	5.0	30.0	9.1	3.8	17.9	30
9	*Eragrostis japonica* (Thunb.) Trin.	55	15.2	5.5	15.2	30.0	9.1	10.3	34.5	30
Shrubby Layer										
1	*Indigofera hetrantha* Wall.	296	71.2	29.6	71.2	80.0	30.8	65.4	167.3	80
2	*Plectranthus rugosus* Wall. ex Benth.	75	18.0	7.5	18.0	90.0	34.6	26.3	78.9	90
3	*Rubus fruticosus* L.	32	7.7	3.2	7.7	50.0	19.2	6.0	32.9	50
4	*Sarcococca saligna* (D.Don) Muell.	10	2.4	1.0	2.4	20.0	7.7	1.2	11.3	20
5	*Vibernum grandiflorum* Wall. Ex DC.	3	0.7	0.3	0.7	20.0	7.7	1.2	9.6	20
Tree Layer										
1	*Pinus wallichiana* A. B. Jackson.	38	90.5	3.8	90.5	100.0	90.9	35.6	217.0	100
2	*Picea smithiana* (Wall.) Boiss.	4	9.5	0.4	9.5	10.0	9.1	64.4	83.0	10

Table 4.1.3 Phytosociological attributes of Bakht Banda, Site Three, Spring Season Chakesar Valley, Shangla.

				Community Attributes						
No	Herbaceous Layer	No	%	Density	R.Density	Frequency	R.Freq.	RCC	IV	Constancy
1	*Cannabis sativa* Linn.	274	54.0	27.4	53.5	100.0	24.4	50.3	128.2	100
2	*Tagetes erecta* Linn.	35	6.9	3.5	6.8	50.0	12.2	3.1	22.2	50
3	*Artemisia dubia* Wall.	142	28.0	14.2	27.7	90.0	22.0	30.7	80.4	90
4	*Conyza bonariansis* (Linn.) Cronquist	11	2.2	1.1	2.1	20.0	4.9	1.3	8.3	20
5	*Verbascum thapsis* L.	37	7.3	3.7	7.2	70.0	17.1	12.8	37.1	70
6	*Saussoria albescens* (DC)Sch. Bip	1	0.2	0.1	0.2	10.0	2.4	0.6	3.3	10
7	*Arisaema flavum* (Forssk.) Schott.	2	0.4	0.2	0.4	20.0	4.9	0.6	5.9	20
8	*Geranium rotundifolium* Linn.	5	1.0	0.5	1.0	20.0	4.9	0.6	6.5	20
9	*Androsace rotundifolia* Hardw.	5	1.0	0.5	1.0	30.0	7.3	0.9	9.2	30
Shrubby Layer										
1	*Berberis lycium* Royle.	49	58.3	4.9	58.3	50.0	35.7	75.3	169.3	50
2	*Desmodium elegans* DC.	5	6.0	0.5	6.0	20.0	14.3	3.5	23.8	20
3	*Sarcococca saligna* (D.Don) Muell.	25	29.8	2.5	29.8	50.0	35.7	17.7	83.1	50
4	*Vibernum grandiflorum* Wall. Ex DC.	5	6.0	0.5	6.0	20.0	14.3	3.5	23.8	20
Tree layer										
1	*Pinus wallichiana* A. B. Jackson.	23	69.7	2.3	69.7	80.0	57.1	65.0	191.9	80
2	*Quercus dilatata* Lindl.	10	30.3	1.0	30.3	60.0	42.9	35.0	108.1	60

Table 4.1.4. Phytosociological attributes of Bakht Banda, Site Four, Spring Season Chakesar Valley, Shangla.

				Community Attributes						
No	**Herbaceous Layer**	No	%	Density	R.Density	Frequency	R.Freq.	RCC	IV	constancy
1	*Bromus japonica* Thunb.	194	25.5	19.4	25.5	60.0	15.4	18.8	59.7	60
2	*Arisaema flavum* (Forssk.) Schott.	3	0.4	0.3	0.4	30.0	7.7	1.5	9.5	30
3	*Cannabis sativa* Linn.	267	35.1	26.7	35.1	70.0	17.9	46.2	99.2	70
4	*Oxalis pes-capre* Linn.	13	1.7	1.3	1.7	30.0	7.7	1.5	10.9	30
5	*Sonchus arvensis* (DC) Kirp.	9	1.2	0.9	1.2	30.0	7.7	1.5	10.3	30
6	*Plantigo lanceolata* Linn.	3	0.4	0.3	0.4	30.0	7.7	1.5	9.5	30
7	*Rumex dentatus* Linn.	102	13.4	10.2	13.4	50.0	12.8	12.7	38.9	50
8	*Gerardiana palmata* (Forssk.)Gaud.	149	19.6	14.9	19.6	50.0	12.8	14.6	47.0	50
9	*Trifolium repense* Linn.	20	2.6	2.0	2.6	40.0	10.3	1.9	14.8	40
Shrubby layer										
1	*Vibernum grandiflorum* Wall. Ex DC.	8	100.0	0.8	100.0	20.0	100.0	100.0	300.0	20
Tree layer										
1	*Pinus wallichiana* A. B. Jackson.	39	66.1	3.9	66.1	100.0	50.0	0.4	116.5	100
2	*Juglan regia* L.	4	6.8	0.4	6.8	20.0	10.0	64.7	81.4	20
3	*Picea smithiana* (Wall.) Boiss.	4	6.8	0.4	6.8	20.0	10.0	17.4	34.1	20
4	*Quercus incana* Roxb.	6	10.2	0.6	10.2	30.0	15.0	8.8	33.9	30
5	*Hedra helix* L.	6	10.2	0.6	10.2	30.0	15.0	8.6	33.8	30

Table 4.1.5 Phytosociological attributes of Bakht Banda, Site Five, Spring Season Chakesar Valley, Shangla.

	Name of the species			Community Attributes						
No	**Herbs layer**	No	%	D	RD	F	RF	RCC	IV	Constancy
	Plectranthus rugosus Wall. ex Benth.	111	68	11	68	100	45	68	181	100
	Berberis kunawarensis Royle.	46	28	5	28	80	36	30	94	80
	Tagetes erecta Linn.	7	4	1	4	40	18	2	24	40
Tree Layer										
	Pinus wallichiana A. B. Jackson.	41	93	4	93	100	77	75	245	100
	Juglan regia L.	1	2	0	2	10	8	10	20	10
	Ailanthus altissima (Miller) Swingle	2	5	0	5	20	15	15	35	20

Table 4.2.1. Phytosociological attributes of Bakht Banda, Site One, Summer Season Chakesar Valley, Shangla.

No	Name of the specie	Community Attributes							
	Herbaceous layer	No	D	RD	F	RF	RCC	IV	Constancy
1	*Aristida depressa* Retz., Ohs.	509	50.9	46.3	100.0	16.9	31.2	94.4	100
2	*Oxalis corniculata* Linn.	103	10.3	9.4	30.0	5.1	9.4	23.9	30
3	*Galium aparine* Linn.	32	3.2	2.9	30.0	5.1	2.4	10.4	30
4	*Conyza bonariansis* (Linn.) Cronquist	21	2.1	1.9	20.0	3.4	2.1	7.4	20
5	*Artemisia japonica* Thunb., Fl. Jap.	14	1.4	1.3	40.0	6.8	2.7	10.7	40
6	*Saussoria albescens* (DC)Sch. Bip	3	0.3	0.3	20.0	3.4	2.1	5.7	20
7	*Valeriana* spp.	21	2.1	1.9	40.0	6.8	7.1	15.8	40
8	*Micromaria biflora* (Ham.) Benth.	14	1.4	1.3	10.0	1.7	1.8	4.7	10
9	*Geranium rotundifolium* Linn.	17	1.7	1.5	20.0	3.4	2.1	7.0	20
10	*Androsace rotundifolia* Hardw.	33	3.3	3.0	30.0	5.1	0.9	9.0	30
11	*Rumex aviculare* L.	12	1.2	1.1	30.0	5.1	3.9	10.0	30
12	*Plantigo major* Linn.	26	2.6	2.4	30.0	5.1	2.4	9.8	30
13	*Brachiaria reptens* (L.) Stapf.	46	4.6	4.2	40.0	6.8	9.7	20.7	40
14	*Arisaema jacquemonti* Blume	98	9.8	8.9	40.0	6.8	6.8	22.5	40
15	*Pimpinella diversifolia* DC.	4	0.4	0.4	30.0	5.1	2.4	7.8	30
16	*Stachys seriaca* Wall. ex Benth.	10	1.0	0.9	10.0	1.7	0.3	2.9	10

17	*Sonchus arvensis* (DC) Kirp.	1	0.1	0.1	10.0	1.7	0.3	2.1	10
18	*Urtica dioica* Linn.	135	13.5	12.3	60.0	10.2	12.7	35.1	60
Shruuby Layer									
1	*Sarcococca saligna* (D.Don) Muell.	340	34.0	46.8	40.0	17.4	41.8	106.0	40
2	*Vibernum grandiflorum* Wall. Ex DC.	93	9.3	12.8	70.0	30.4	11.5	54.7	70
3	*Desmodium elegans* DC.	120	12.0	16.5	20.0	8.7	20.5	45.7	20
4	*Hedra helix* L.	6	0.6	0.8	40.0	17.4	0.8	19.0	40
5	*Andrachne cordifolia* (Decne.) Mull. Arg.	151	15.1	20.8	40.0	17.4	17.2	55.4	40
6	*Berberis lycium* Royle.	17	1.7	2.3	20.0	8.7	8.6	19.6	20
Tree layer									
1	*Pinus wallichiana* A. B. Jackson.	75	7.5	84.3	90.0	90.0	73.9	248.1	90
2	*Quercus dilatata* Lindl.	14	1.4	15.7	10.0	10.0	26.1	51.9	10
		89	8.9	100.0	100.0	100.0	100.0	300.0	100

Table 4.2.2 Phytosociological attributes of Bakht Banda, Site two, Summer Season Chakesar Valley, Shangla.

	Species Name	Community Attributes							
	Herbaceous layer	No	D	RD	F	RF	RCC	IV	Constancy
1	*Brachiaria reptens* (L.) Stapf.	30	3.0	4.1	100.0	14.9	2.3	21.3	100
2	*Galium aparine* Linn.	10	1.0	1.4	100.0	14.9	0.4	16.7	100
3	*Plantigo lanceolata* Linn.	9	0.9	1.2	30.0	4.5	3.1	8.8	30
4	*Artemisia vulgare* L.	94	9.4	12.8	40.0	6.0	16.0	34.8	40
5	*Dactylis glomerata* L.	251	25.1	34.2	90.0	13.4	41.2	88.8	90
6	*Silene conoide* Linn.	10	1.0	1.4	10.0	1.5	0.4	3.2	10
7	*Medicago sativa* Linn.	15	1.5	2.0	10.0	1.5	2.3	5.8	10
8	*Hypericum perforatum* L.	6	0.6	0.8	20.0	3.0	0.8	4.6	20
9	*Conyza aegyptiaca* L.	42	4.2	5.7	30.0	4.5	3.1	13.3	30
10	*Achyranthes aspera* L.	69	6.9	9.4	30.0	4.5	6.9	20.8	30

11	*Eremostachys thyrsiflora* Bunge in Ledeb.,	48	4.8	6.5	40.0	6.0	9.3	21.8	40
12	*Oxalis pes-capre* Linn.	51	5.1	6.9	40.0	6.0	1.5	14.5	40
13	*Urtica dioica* Linn.	45	4.5	6.1	30.0	4.5	5.0	15.6	30
14	*Urtica hyperborea* L.	6	0.6	0.8	20.0	3.0	0.8	4.6	20
15	*Heliotrophium ophioglossum* Stocks ex Boiss.	6	0.6	0.8	30.0	4.5	1.2	6.5	30
16	*Chenopodium album* Linn.	3	0.3	0.4	10.0	1.5	2.3	4.2	10
17	*Mentha longifolia* (L.) Hudson.	28	2.8	3.8	20.0	3.0	2.7	9.5	20
18	*Sonchus arvensis* (DC) Kirp.	11	1.1	1.5	20.0	3.0	0.8	5.3	20
SHRUBBY LAYER									
1	*Indigofera hetrantha* Wall.	175	17.5	53.0	50.0	50.0	50.0	153.0	50
2	*Plectranthus rugosus* Wall. ex Benth.	155	15.5	47.0	50.0	50.0	50.0	147.0	50
TREE LAYER									
1	*Pinus wallichiana* A. B. Jackson.	25	2.5	100.0	100.0	100.0	100.0	300.0	100

Table 4.2.3. Phytosociological attributes of Bakht Banda, Site three, Summer Season Chakesar Valley, Shangla.

S.No	Name of the specie		Community Attributes						
	Herbaceous layer	No	D	RD	F	RF	RCC	IV	Constancy
1	*Stachys seriaca* Wall. ex Benth.	324	32.4	31.9	90.0	35.6	39.7	107.2	90
2	*Bromus japonica* Thunb.	398	39.8	39.2	90.0	35.6	35.1	109.9	90
3	*Setaria*	58	5.8	5.7	4.0	1.6	8.5	15.8	4
4	*Galium aparine* Linn.	157	15.7	15.5	5.0	2.0	7.4	24.9	5
5	*Lespedeza juncea* (Linn.f) Pers.	21	2.1	2.1	4.0	1.6	1.5	5.1	4
6	*Artemisia japonica* Thunb., Fl. Jap.	10	1.0	1.0	10.0	4.0	0.4	5.3	10
7	*Rumex dentatus* Linn.	2	0.2	0.2	10.0	4.0	0.4	4.5	10

8	*Achyranthes aspera* L.	5	0.5	0.5	20.0	7.9	4.5	12.9	20
9	*Pimpinella diversifolia* DC.	40	4.0	3.9	20.0	7.9	2.6	14.4	20
Shrubby layer									
1	*Desmodium elegans* DC.	103	10.3	14.8	40.0	16.0	5.5	36.4	40
2	*Berberis lycium* Royle.	277	27.7	39.9	80.0	32.0	36.2	108.1	80
3	*Indigofera hetrantha* Wall.	157	15.7	22.6	60.0	24.0	17.3	63.9	60
4	*Plectranthus rugosus* Wall. ex Benth.	157	15.7	22.6	70.0	28.0	41.0	91.6	70
Tree layer									
1	*Pinus wallichiana* A. B. Jackson.	33	3.3	94.3	100.0	83.3	71.1	248.7	100
2	*Quercus dilatata* Lindl.	2	0.2	5.7	20.0	16.7	28.9	51.3	20

Table 4.2.4. Phytosociological attributes of Bakht Banda, Site Four, Summer Season Chakesar Valley, Shangla.

	Name of the species		Community Attributes						
S.No	**Herbaceous layer**	No	D	RD	F	RF	RCC	IV	Constancy
1	*Cynodon dactylon* (L.) Pers.	457	45.7	74.1	80.0	15.4	58.0	147.4	80
2	*Taraxicum officinale* Weber	49	4.9	7.9	40.0	7.7	7.0	22.6	40
3	*Rumex aviculare* L.	25	2.5	4.1	70.0	13.5	6.2	23.7	70
4	*Oxalis corniculata* Linn.	12	1.2	1.9	60.0	11.5	2.6	16.0	60
5	*Rumex dentatus* Linn.	13	1.3	2.1	50.0	9.6	1.8	13.6	50
6	*Malva neglecta* Wallr.	4	0.4	0.6	30.0	5.8	1.0	7.4	30
7	*Galium aparine* Linn.	18	1.8	2.9	20.0	3.8	2.6	9.3	20
8	*Cannabis sativa* Linn.	15	1.5	2.4	20.0	3.8	4.4	10.7	20
9	*Arisaema flavum* (Forssk.) Schott.	3	0.3	0.5	30.0	5.8	4.8	11.0	30
10	*Arisaema jacquemonti* Blume	3	0.3	0.5	20.0	3.8	2.6	6.9	20
11	*Trichodesma indica* (L.) R. Br.	8	0.8	1.3	50.0	9.6	3.7	14.6	50
12	*Heliotropium strigosum* Willd.	10	1	1.6	50.0	9.6	5.5	16.7	50
Shrubby layer									
1	*Plectranthus rugosus* Wall. ex Benth.	10	1	47.6	30.0	42.9	42.3	132.7	30
2	*Vibernum grandiflorum* Wall. Ex DC.	11	1.1	52.4	40.0	57.1	57.7	167.3	40
Tree layer									
1	*Pinus wallichiana* A. B. Jackson.	19	1.9	57.6	60.0	39.2	41.4	138.2	60
2	*Juglan regia* L.	5	0.5	15.2	50.0	32.7	19.6	67.4	50
3	*Picea smithiana* (Wall.) Boiss.	5	0.5	15.2	3.0	2.0	16.1	33.2	3
4	*Abies pindrow* Royle	4	0.4	12.1	40.0	26.1	22.9	61.2	40

Table 4.2.5. Phytosociological attributes of Bakht Banda, Site Five, Summer Season Chakesar Valley, Shangla.

	Name of the specie		Community Attributes						
S.No	**Herbaceous layer**	No	D	RD	F	RF	RCC	IV	Constancy
1	*Imaptiens balsiminea* Linn.	613	61.3	42.1	70.0	18.9	39.1	100.1	70
2	*Cannabis sativa* Linn.	23	2.3	1.6	20.0	5.4	1.8	8.8	20
3	*Heliotropium strigosum* Willd.	617	61.7	42.4	50.0	13.5	34.8	90.7	50
4	*Oxalis pes-capre* Linn.	11	1.1	0.8	30.0	8.1	0.8	9.7	30
5	*Arisaema flavum* (Forssk.) Schott.	17	1.7	1.2	40.0	10.8	5.0	17.0	40
6	*Arisaema jacquemonti* Blume	4	0.4	0.3	20.0	5.4	0.5	6.2	20
7	*Geum elatum* L.	4	0.4	0.3	20.0	5.4	0.5	6.2	20
8	*Rumex hastatus* D. Don..	5	0.5	0.3	10.0	2.7	0.5	3.6	10
9	*Rumex dentatus* Linn.	37	3.7	2.5	10.0	2.7	3.9	9.1	10
10	*Duchesnia indica* forsk.	10	1	0.7	30.0	8.1	1.1	9.8	30
11	*Geranium wallichianum* D. Don.	6	0.6	0.4	30.0	8.1	0.6	9.2	30
12	*Urtica dioica* Linn.	108	10.8	7.4	40.0	10.8	11.4	29.6	40
Shrubby layer									
1	*Davallia denticulata* (Burm. f.) Mett. ex Kuhn	110	11	30.1	30.0	18.8	23.2	72.1	30
2	*Vibernum grandiflorum* Wall. Ex DC.	84	8.4	23.0	30.0	18.8	28.0	69.7	30
3	*Indigofera hetrantha* Wall.	120	12	32.9	50.0	31.3	36.3	100.4	50
4	*Plectranthus rugosus* Wall. ex Benth.	51	5.1	14.0	50.0	31.3	12.6	57.8	50
Tree layer									
1	*Pinus gerardiana* Wall. ex Lamb.	1	0.1	1.7	20.0	9.5	49.0	60.2	20

2	*Abies pindrow* Royle	7	0.7	12.1	30.0	14.3	8.1	34.5	30
3	*Pinus wallichiana* A. B. Jackson.	41	4.1	70.7	100.0	47.6	12.2	130.5	100
4	*Picea smithiana* (Wall.) Boiss.	5	0.5	8.6	20.0	9.5	6.2	24.4	20
5	*Juglan regia* L.	4	0.4	6.9	40.0	19.0	24.5	50.4	40

Table 4.3.1 Phytosociological attributes of Bakht Banda, Site One, Winter Season Chakesar Valley, Shangla.

				Community Attributes						
	Name of the specie	No	%	D	RD	F	RF	RCC	IV	Constancy
No	Herbs layer									
1	Parthenium	65	64.4	6.5	64.4	90.0	56.3	51.2	171.8	90
2	*Tagetes erecta* Linn.	7	6.9	0.7	6.9	20.0	12.5	8.4	27.8	20
3	*Rumex hastatus* D. Don..	27	26.7	2.7	26.7	40.0	25.0	39.2	91.0	40
4	*Verbascum thapsis* L.	2	2.0	0.2	2.0	10.0	6.3	1.2	9.4	10
Shruby Layer										
1	*Plectranthus rugosus* Wall. ex Benth.	85	55.2	8.5	55.2	30.0	18.8	37.0	110.9	30
2	*Rubus fruticosus* L.	13	8.4	1.3	8.4	50.0	31.3	12.5	52.2	50
3	*Rosa macrophylla* Lindl.	38	24.7	3.8	24.7	60.0	37.5	37.3	99.5	60
4	*Indigofera hetrantha* Wall.	8	5.2	0.8	5.2	10.0	6.3	5.0	16.4	10
5	*Berberis kunawarensis* Royle.	10	6.5	1.0	6.5	10.0	6.3	12.3	25.1	10
Tree Layer										
1	*Pinus wallichiana* A. B. Jackson.	37	24.0	3.7	100.0	100.0	100.0	100.0	300.0	100

Table 4.3.2 Phytosociological attributes of Bakht Banda, Site Two, Winter Season Chakesar Valley, Shangla.

				Community Attributes						
	Name of the specie	No	%	D	RD	F	RF	RCC	IV	Constancy
No	**Herbs layer**									
1	*Verbascum thapsis* L.	1	0.5	0.1	0.5	10.0	5.9	0.9	7.3	10.0
2	*Tagetes erecta* Linn.	8	4.4	0.8	4.4	50.0	29.4	4.3	38.1	50.0
3	*Cenchrus ciliaris* L.	81	44.5	8.1	44.5	60.0	35.3	53.8	133.6	60.0
4	*Rumex hastatus* D. Don..	92	50.5	9.2	50.5	50.0	29.4	41.0	121.0	50.0
Shruby Layer										
1	*Plectranthus rugosus* Wall. ex Benth.	316	91.9	31.6	91.9	100.0	71.4	88.7	252.0	100.0
2	*Indigofera hetrantha* Wall.	5	1.5	0.5	1.5	10.0	7.1	2.7	11.3	10.0
3	*Dactylis glomerata* L.	23	6.7	2.3	6.7	30.0	21.4	8.2	36.3	30.0
Tree Layer										
1	*Pinus wallichiana* A. B. Jackson.	44	100.0	4.4	100.0	100.0	100.0	100.0	300.0	100.0

Table 4.4 Physiochemical analysis of Soil of Bakht Banda Hills, Chakesar, District Shangla.

No	Sites	Altitude	Soil Temperature	Soil Color	Slope	Location	Habitat	Textural of soil	Soil Ph	EC	Ex. Na	Organic matter	Nitrogen (%)	P (%)	Ex. K (%)
1	Kandao	1975	23.5	Brown	60	N	Moist	Sand	7.4	0.04	0.2	0.31	0.019	4	30
2	Kandao 01	2100	22	Brown	55	W	Moist	Loamy	7.2	0.04	0.2	0.54	0.034	5	80
3	Saidan	2225	22	Black	40	N	Moist	Loamy sand	7	0.12	0.2	2.07	0.129	9	100
4	Garang	2350	23	Black	45	N	Moist	Loamy sand	6.8	0.07	0.3	2.23	0.139	12	60
5	Garang Top	2475	21	Brown	52	E	Moist	Loamy sand	6.5	0.1	0.4	0.76	0.048	10	60

Table 4.5. Environmental variables of Bakht Banda hills, Chakesar valley, District Shangla.

Stands	Locations	Altitude	Temperature(F)	PAR Light (µM/m^2S)	Leaf wetness (LW)	Solar rad (Wat/m2)	RH (%)	WND (Deg)	WNS (mph)
1	Kandao	1975	80.5	784	14	1560	69.2	55	16
2	Kandao 01	2100	76.7	670	14	1020	68.7	62	37
3	Saidan	2225	75.2	740	15	740	65.1	63	24
4	Garang	2350	72.6	1040	14	940	64.7	77	10
5	Garang Top	2475	70.5	645	14	1105	58.1	100	44

Table.4.6 Communities attributes of Bakht Banda Hill Chakesar, District Shangla.

		Stand	No	Species Richness	Diversity	MI	E
Bakht Banda Hills	Spring	1	20	0.771	2.5	36	0.31
		2	16	0.558	2.03	43.8	0.26
		3	16	0.598	1.792	43.1	0.21
		4	16	0.521	1.83	38.1	0.22
		5	6	0.234	1.06	37.2	0.2
	Summer	1	26	0.6	2.5	35.4	0.28
		2	21	0.64	2.44	41.4	0.29
		3	21	0.337	2.1	35.2	0.24
		4	18	0.7	1.43	42.8	0.12
		5	21	0.54	1.21	30.2	0.1
	Winter	1	10	0.585	1.9	42	0.28
		2	8	0.293	1.3	51.3	0.13
		3	11	0.474	1.9	66.4	0.27
		4	4	0.331	1.2	62.5	0.13
		5	6	0.416	1.2	58.3	0.1

Table 4.7 Comparative indices of similarities between different seasons of Bakht Banda Hills Chakesar Valley, District Shangla.

Spring					
	A	B	C	D	E
A	0				
B	76	0			
C	65	53	0		
D	65	90	68	0	
E	36	31	33	33	0

Summer					
	A	B	C	D	E
A	0				
B	17	0			
C	29	28	0		
D	23	15	24	0	
E	17	24	22	51	0

Winter					
	A	B	C	D	E
A	0				
B	67	0			
C	48	42	0		
D	29	33	40	0	
E	25	29	47	60	0

Table 4.8 Degree of homogeneity of Bakht Banda Hills, Chakesar Valley, District Shangla.

Stand	Spring	Summer	Winter
1	A < B > C ≤ ≥ D > E	A < B > C ≤ ≥ D = E	A > B = C > D < E
2	A > B > C > D > E	A > B > C > D < E	A > B < C > D = E
3	A > B < C > D > E	A > B = C < D > E	A > B > C < D > E
4	A < B > C > D > E	A < B > C > D > E	A < B > C < D > E
5	A > B > C < D > E	A < B > C > D > E	A > B < C < D = E

Table 4.9.1 Regeneration Capacity of Spring Flora of Bakht Banda Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Ailanthus altissima* (Miller) Swingle		2	1	1				
2	*Hedra helix* L.	4	2						
3	*Juglan regia* L.			2	2				
4	*Picea smithiana* (Wall.) Boiss.		2		2	1	3		
5	*Pinus wallichiana* A. B. Jackson.	1	16	19	48	22	18	12	5
6	*Quercus dilatata* Lindl.	3	5	5	1				
7	*Quercus incana* Roxb.	2		1		1			

Table 4.9.2 Regeneration Capacity of Summer Flora of Bakht Banda Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Abies pindrow* Royle		4	3	2	2			
2	*Pinus gerardiana* Wall. ex Lamb.						1		
3	*Juglan regia* L.		2	2	1				
4	*Picea smithiana* (Wall.) Boiss.		2	5	2	1			
5	*Pinus wallichiana* A. B. Jackson.	11	2	48	49	42	19	9	6
6	*Quercus dilatata* Lindl.		1	4					

Table 4.9.3 Regeneration Capacity of Winter Flora of Bakht Banda Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Ailanthus altissima* (Miller) Swingle	15	18	18	29	23	21	23	21
2	*Diospyrus kaki* Linn.					1			
3	*Juglan regia* L.			1		1			
4	*Pinus wallichiana* A. B. Jackson.	1			1				

Table 5.1.1 Phytosociological attributes of Dhali, Site One, Spring Season Chakesar Valley, Shangla.

	Name of Plants			Community Attributes						
	Herbaceous Layer	No	%	D	RD	F	RF	RCC	IV	Constancy
1	*Cannabis sativa* Linn.	200	58.7	20.0	58.7	50.0	17.2	63.9	139.8	50
2	*Artemisia dubia* Wall.	62	18.2	6.2	18.2	50.0	17.2	11.5	46.9	50
3	*Conyza bonnariansis* (Linn.) Cronquist.	2	0.6	0.2	0.6	10.0	3.4	0.8	4.8	10
4	*Xanthium strumarium* Linn.	10	2.9	1.0	2.9	10.0	3.4	4.6	11.0	10
5	*Calotropis procera* (Ait.) Ait. F.	1	0.3	0.1	0.3	10.0	3.4	0.8	4.5	10
6	*Verbena officinalis* Linn.	1	0.3	0.1	0.3	10.0	3.4	0.8	4.5	10
7	*Cyanodon dactylon*(L.) Pers.	7	2.1	0.7	2.1	10.0	3.4	0.8	6.3	10
8	*Poa annua* L.	3	0.9	0.3	0.9	10.0	3.4	0.8	5.1	10
9	*Dryopteris* Adans.	7	2.1	0.7	2.1	10.0	3.4	4.6	10.1	10
10	*Heliotropium strigosum* Willd.	4	1.2	0.4	1.2	20.0	6.9	1.5	9.6	20
11	*Tagetes erecta* Linn.	5	1.5	0.5	1.5	10.0	3.4	0.8	5.7	10
12	*Polygonum aviculare* Linn.	6	1.8	0.6	1.8	10.0	3.4	0.8	6.0	10
13	*Oxalis corniculata* Linn.	12	3.5	1.2	3.5	20.0	6.9	1.5	12.0	20
14	*Cordia gharaf* (Forssk.) Ehren ex Asch.,	1	0.3	0.1	0.3	10.0	3.4	0.8	4.5	10
15	*Salvia moorcroftiana*Wall.	4	1.2	0.4	1.2	10.0	3.4	1.5	6.2	10
16	*Amaranthus viridus* L.	11	3.2	1.1	3.2	20.0	6.9	1.5	11.7	20
17	*Ajuga parviflora* Benth.	2	0.6	0.2	0.6	10.0	3.4	1.5	5.6	10
18	*Ajuga bracteosa* Wallich ex Benth.	3	0.9	0.3	0.9	10.0	3.4	1.5	5.9	10
Shrubby layer										
1	*Rubus ellipticus* Smith	10	47.6	1.0	47.6	10.0	33.3	28.8	109.8	10
2	*Punica granatum* L.	11	52.4	1.1	52.4	20.0	66.7	71.2	190.2	20
Tree layer										

1	*Ficus palmata* Forssk.	8	50.0	0.8	50.0	20.0	40.0	51.9	141.9	20
2	*Ailanthus altissima*(Miller) Swingle.	8	50.0	0.8	50.0	30.0	60.0	48.1	158.1	30

Table 5.1.2 Phytosociological attributes of Dhali, Site Two, Spring Season Chakesar Valley, Shangla.

	Name of Plants			Community Attributes						
No	Herbaceous Layer	Number	%	Density	R.Density	Freq	R.Freq.	RCC	IV	Cons.
1	*Cannabis sativa* Linn.	159	17.9	15.9	18.4	60	12.2	17.1	47.7	60
2	*Aconitum violata* Jacque. Staff.	28	3.2	2.8	3.2	50	10.2	3.5	17.0	50
3	*Parthenium*	103	11.6	10.3	11.9	60	12.2	12.3	36.4	60
4	*Polygonum aviculare* Linn.	12	1.4	1.2	1.4	20	4.1	0.7	6.2	20
5	*Aristida cyanantha* Steud.	63	7.1	6.3	7.3	50	10.2	11.2	28.7	50
6	*Artemisia vulgare* L.	162	18.3	16.2	18.7	70	14.3	14.4	47.4	70
7	*Rumex aviculare* L.	28	3.2	2.8	3.2	20	4.1	2.5	9.8	20
8	*Adiantum incisum* Forssk.	17	1.9	1.7	2.0	20	4.1	2.4	8.4	20
9	*Calendula arvensis* Linn.	263	29.7	26.3	30.4	80	16.3	29.7	76.4	80
10	*Scirpus atrovirens* L.	37	4.2	3.7	4.3	30	6.1	5.4	15.7	30
11	*Duchesnia indica* forssk.	14	1.6	1.4	1.6	30	6.1	1.1	8.8	30
Shrubby Layer										
1	*Indigofera hetrantha* Wall.	162	71.7	16.2	73.0	70	53.8	79.9	206.7	70
2	*Zanthoxylum armatum* DC.	49	21.7	4.9	22.1	40	30.8	16.0	68.8	40
3	*Hedra helix* L.	15	6.6	1.5	6.8	20	15.4	4.7	26.8	20
Tree Layer										
1	*Celtis australis* Wild.	2	5.7	0.2	5.7	20	13.3	24.2	43.2	20
2	*Salix tetrasperma* Roxb. Pl. Corom.	6	17.1	0.6	17.1	20	13.3	11.4	41.9	20
3	*Melia azadarichta* Linn.	7	20.0	0.7	20.0	20	13.3	7.3	40.7	20

4	*Morus alba* Linn.	3	8.6	0.3	8.6	20	13.3	35.7	57.6	20
5	*Pinus roxburghii* Sargent.	17	48.6	1.7	48.6	70	46.7	21.4	116.6	70

Table 5. 1.3. Phytosociological attributes of Dhali, Site Three, Spring Season Chakesar Valley, Shangla.

	Plant Names			Community Attributes						
No	Herbaceous layer	No of Plants	%	D	RD	F	RF	RCC	IV	Constancy
1	*Poa annua* L.	320	40.6	32.0	40.6	90.0	18.4	23.6	82.5	90
2	*Sorghum hephalensis* (L.) Hill.	127	16.1	12.7	16.1	50.0	10.2	37.4	63.7	50
3	*Tagetes erecta* Linn.	32	4.1	3.2	4.1	30.0	6.1	6.6	16.8	30
4	*Scripus atrovirens* L.	51	6.5	5.1	6.5	40.0	8.2	4.6	19.2	40
5	*Scirpus Americana* L.	56	7.1	5.6	7.1	40.0	8.2	9.7	24.9	40
6	*Scirpus debalis*	27	3.4	2.7	3.4	30.0	6.1	4.0	13.6	30
7	*Cyperus dentatus* Torr.	72	9.1	7.2	9.1	20.0	4.1	6.1	19.3	20
8	*Cyperus rotundus* Linn.	15	1.9	1.5	1.9	20.0	4.1	1.0	7.0	20
9	*Rumex aviculare* L.	3	0.4	0.3	0.4	20.0	4.1	0.5	5.0	20
10	*Artemisia scoparia* Waldst. & Kit.	32	4.1	3.2	4.1	40.0	8.2	1.5	13.7	40
11	*Duchesnia indica* forssk.	4	0.5	0.4	0.5	30.0	6.1	1.5	8.1	30
12	*Cannabis sativa* Linn.	28	3.5	2.8	3.5	30.0	6.1	1.5	11.2	30
13	*Ajuga bracteosa* Wallich ex Benth.	2	0.3	0.2	0.3	20.0	4.1	1.0	5.3	20
14	*Calendula arvensis* Linn.	20	2.5	2.0	2.5	30.0	6.1	1.0	9.7	30
Shrubby layer										
1	*Rubus fruticosus* L.	20	19.4	2.0	19.4	30.0	17.6	26.2	63.3	30
2	*Indigofera hetrantha* Wall.	18	17.5	1.8	17.5	40.0	23.5	17.4	58.4	40
3	*Plectranthus rogusus* L.	30	29.1	3.0	29.1	40.0	23.5	30.9	83.6	40
4	*Rubus sanctus* Schreb.	20	19.4	2.0	19.4	40.0	23.5	13.7	56.6	40
5	*Sarcococca saligna* (D.Don)	15	14.6	1.5	14.6	20.0	11.8	11.7	38.1	20

	Muell.									
Tree layer										
1	*Ailanthus altissima* (Miller) Swingle	20	33.3	2.0	33.3	60.0	30.0	7.5	70.8	60
2	*Hedra helix* L.	3	5.0	0.3	5.0	20.0	10.0	3.0	18.0	20
3	*Pinus roxburghii* Sargent.	25	41.7	2.5	41.7	60.0	30.0	29.7	101.4	60
4	*Pinus wallichiana* A. B. Jackson.	10	16.7	1.0	16.7	40.0	20.0	30.8	67.5	40
5	*Pyrus pashia* Ham.	1	1.7	0.1	1.7	10.0	5.0	20.6	27.2	10
6	*Diospyrus kaki* Linn.	1	1.7	0.1	1.7	10.0	5.0	8.4	15.1	10

Table 5. 2. 1. Phytosociological attributes of Dhali, Site One, Summer Season Chakesar Valley, Shangla.

	Name of Plants		Community Attributes						
S.No	**Herbaceous Layer**	Number	Density	R.Density	Frequency	R.Freq.	RCC	IV	Connstancy
1	*Euphorbia hirta* L.	23	2.3	7.1	40.0	11.4	4.7	23.2	40
2	*Chrysopogon aucheri* (Boiss.) Stapf	16	1.6	4.9	20.0	5.7	6.3	16.9	20
3	*Sorghum nephalensis* (L.) Hill.	21	2.1	6.5	30.0	8.6	6.8	21.9	30
4	*Micromaria biflora* (Ham.) Benth.	38	3.8	11.7	60.0	17.1	8.4	37.2	60
5	*Cynodon dactylon* (L.) Pers.	78	7.8	24.1	30.0	8.6	22.3	54.9	30
6	*Themeda anathera* (Nees ex Steud.) Hack.	26	2.6	8.0	30.0	8.6	9.4	26.0	30
7	*Asplenium marinum* L.	23	2.3	7.1	20.0	5.7	8.3	21.1	20
8	*Conyza aegyptiaca* L.	24	2.4	7.4	30.0	8.6	6.8	22.8	30
9	*Oxalis corniculata* Linn.	7	0.7	2.2	30.0	8.6	1.6	12.3	30
10	*Adiantum incisum* Forsk.	28	2.8	8.6	20.0	5.7	8.3	22.6	20
11	*Aristida cyanantha* Steud.	40	4.0	12.3	40.0	11.4	17.2	40.9	40
Shrubby layer									
1	*Berberis lycium* Royle.	60	6.0	82.2	50.0	45.5	45.5	173.1	50
2	*Rubus fruticosus* L.	1	0.1	1.4	10.0	9.1	9.1	19.6	10

3	*Daphne oloides* Schreb.	8	0.8	11.0	20.0	18.2	18.2	47.3	20
4	*Rosa macrophylla* Lindl.	2	0.2	2.7	20.0	18.2	18.2	39.1	20
5	*Dodonaea viscose* Jacq.	2	0.2	2.7	10.0	9.1	9.1	20.9	10
Tree layer									
1	*Ailanthus altissima* (Miller) Swingle	24	2.4	54.5	50.0	38.5	38.5	131.5	50
2	*Prunus armeniaca* Linn.	1	0.1	2.3	10.0	7.7	7.7	17.7	10
3	*Celtis australis* Wild.	3	0.3	6.8	10.0	7.7	7.7	22.2	10
4	*Melia azadarichta* Linn.	1	0.1	2.3	20.0	15.4	15.4	33.0	20
5	*Ficus palmata* Forssk.	1	0.1	2.3	10.0	7.7	7.7	17.7	10
6	*Pinus roxburghii* Sargent.	14	1.4	31.8	30.0	23.1	23.1	78.0	30

Table 5. 2. 2. Phytosociological attributes of Dhali, Site Two, Summer Season Chakesar Valley, Shangla.

	Name of species		Community Attributes						
S.N0	*Herbaceous layer*	No of Plants	D	RD	F	RF	RCC	IV	Constancy
1	*Dactylis glomerata* L.	138	13.8	23.50937	80	15.09434	1.8	40.40371	80
2	*Tagetes erecta* Linn.	80	8	13.62862	80	15.09434	1.9	30.62296	80
3	*Setaria viridis* (Linn.) P. Beauv.	83	8.3	14.13969	50	9.433962	1.8	25.37366	50
4	*Androsace rotundifolia* Hardw.	127	12.7	21.63543	70	13.20755	8.32	43.16298	70
5	*Anagalis arvensis* Linn.	8	0.8	1.362862	40	7.54717	3.88	12.79003	40
6	*Cynodon dactylon* (L.) Pers.	93	9.3	15.84327	90	16.98113	5.8	38.6244	90
7	*Gerbera gossypina* (Royle) Beauv.	10	1	1.703578	40	7.54717	0.4	9.650747	40
8	*Fragaria vesica* Lindl.	48	4.8	8.177172	80	15.09434	0.4	23.67151	80
Shrubby Layer									
1	*Indigofera hetrantha* Wall.	48	4.8	25.80645	50	31.25	15	72.05645	50
2	*Berberis lycium* Royle.	131	13.1	70.43011	80	50	63.33333	183.7634	80

3	*Rosa macrophylla* Lindl.	7	0.7	3.763441	30	18.75	21.66667	44.18011	30

Table 5.2.3. Phytosociological attributes of Dhali, Site Three, Summer Season Chakesar Valley, Shangla.

	Name of species		Community Attributes						
S.No	***Herbaceous layer***	No of Plants	D	RD	F	RF	RCC	IV	Constancy
1	*Cenchrus ciliaris* L.	90	9.0	26.3	90.0	20.9	15.6	62.8	90
2	*Cynodon dactylon* (L.) Pers.	35	3.5	10.2	50.0	11.6	3.2	25.1	50
3	*Tagetes erecta* Linn.	7	0.7	2.0	40.0	9.3	2.6	13.9	40
4	*Dicliptra roxburghiana* Juss.	17	1.7	5.0	30.0	7.0	1.9	13.9	30
5	*Aristida cyanantha* Steud.	45	4.5	13.2	50.0	11.6	16.2	41.0	50
6	*Sorghum nephalensis* (L.) Hill.	102	10.2	29.8	50.0	11.6	42.3	83.8	50
7	*Cyperus rotundus* L.	25	2.5	7.3	50.0	11.6	9.7	28.7	50
8	*Juncus inflexus* L.	13	1.3	3.8	30.0	7.0	1.9	12.7	30
9	*Duchesnia indica* forssk.	4	0.4	1.2	30.0	7.0	1.9	10.1	30
10	*Polygonum aviculare* Linn.	4	0.4	1.2	10.0	2.3	3.9	7.4	10
Shrubby Layer									
1	*Berberis lycium* Royle.	182	18.2	87.9	90.0	47.4	81.8	217.0	90
2	*Indigofera hetrantha* Wall.	4	0.4	1.9	30.0	15.8	3.8	21.5	30
3	*Daphne oloides* Schreb.	15	1.5	7.2	40.0	21.1	10.0	38.3	40
4	*Sarcococca saligna* (D.Don) Muell.	6	0.6	2.9	30.0	15.8	3.8	22.4	30
Tree Layer									
1	*Pinus roxburghii* Royle.	5	0.5	41.7	40.0	57.1		98.8	40
2	*Ailanthus altissima* (Miller) Swingle	7	0.7	58.3	30.0	42.9		101.2	30

Table 5.3.1 Phytosociological attributes of Dhali, Site One, Winter Season Chakesar Valley, Shangla.

	Name of Plants		Community Attributes						
	Herbaceous Layer	Number	Density	R.Density	Frequency	R.Freq.	RCC	IV	constancy
1	*Euphorbia hirta* L.	23	2.3	8.2	40.0	12.1	4.6	24.9	40
2	*Micromaria biflora* (Ham.) Benth.	38	3.8	13.6	60.0	18.2	6.9	38.6	60
3	*Cynodon dactylon* (L.) Pers.	78	7.8	27.9	50.0	15.2	5.7	48.8	50
4	*Asplenium marinum* L.	23	2.3	8.2	20.0	6.1	31.0	45.3	20
5	*Conyza aegyptiaca* L.	24	2.4	8.6	30.0	9.1	14.9	32.6	30
6	*Oxalis corniculata* Linn.	7	0.7	2.5	40.0	12.1	3.4	18.1	40
7	*Adiantum incisum* Forsk.	28	2.8	10.0	20.0	6.1	8.0	24.1	20
8	*Setaria viridis* (Linn.) P. Beauv.	40	4.0	14.3	40.0	12.1	16.1	42.5	40
9	*Dicliptra bupleuroides* Nees	19	1.9	6.8	30.0	9.1	9.2	25.1	30
Shrubby layer									
1	*Berberis lycium* Royle.	60	6.0	82.2	50.0	45.5	75.0	202.6	50
2	*Rubus fruticosus* L.	1	0.1	1.4	10.0	9.1	15.0	25.5	10
3	*Daphne oloides* Schreb.	8	0.8	11.0	20.0	18.2	2.5	31.6	20
4	*Rosa macrophylla* Lindl.	2	0.2	2.7	20.0	18.2	5.0	25.9	20
5	*Dodonaea viscose* Jacq.	2	0.2	2.7	10.0	9.1	2.5	14.3	10
Tree layer									
1	*Ailanthus altissima* (Miller) Swingle	24	2.4	54.5	50.0	38.5	37.4	130.4	50
2	*Prunus armeniaca* Linn.	1	0.1	2.3	10.0	7.7	6.4	16.4	10
3	*Celtis australis* Wild.	3	0.3	6.8	10.0	7.7	2.1	16.7	10
4	*Melia azadarichta* Linn.	1	0.1	2.3	20.0	15.4	8.5	26.2	20
5	*Ficus palmata* Forssk.	1	0.1	2.3	10.0	7.7	8.3	18.3	10
6	*Pinus roxburghii* Sargent.	14	1.4	31.8	30.0	23.1	37.5	92.4	30

Table 5.3.2 Phytosociological attributes of Dhali, Site Two, Winter Season Chakesar Valley, Shangla.

	Name of species			Community Attributes						
No	Herbaceous layer	No of Plants	%	D	RD	F	RF	RCC	IV	Constancy
1	*Tagetes erecta* Linn.	80	36.2	8.0	36.2	80.0	32.0	32.7	100.9	80
2	*Cynodon dactylon* (L.) Pers.	93	42.1	9.3	42.1	90.0	36.0	34.5	112.6	90
3	*Fragaria vesica* Lindl.	48	21.7	4.8	21.7	80.0	32.0	32.7	86.4	80
Shruby Layer										
1	*Indigofera hetrantha* Wall.	48	26.8	4.8	26.8	50.0	38.5	5.0	70.3	50
2	*Berberis lycium* Royle.	131	73.2	13.1	73.2	80.0	61.5	95.0	229.7	80

Table 5.3.3 Phytosociological attributes of Dhali, Site Three, Winter Season Chakesar Valley, Shangla.

			Community Attributes						
No	**Herbaceous layer**	No	D	RD	F	RF	RCC	IV	constancy
1	*Cenchrus ciliaris* L.	90	9	62.5	90.0	42.9	52.2	157.5	90
2	*Cynodon dactylon* (L.) Pers.	35	3.5	24.3	50.0	23.8	10.9	59.0	50
3	*Tagetes erecta* Linn.	7	0.7	4.9	40.0	19.0	19.6	43.5	40
4	*Dicliptra bupleuroides* Nees	12	1.2	8.3	30.0	14.3	17.4	40.0	30
Shrubby Layer									
1	*Berberis lycium* Royle.	182	18.2	87.9	90.0	47.4	81.8	217.0	90
2	*Indigofera hetrantha* Wall.	4	0.4	1.9	30.0	15.8	10.0	27.7	30
3	*Daphne oloides* Schreb.	15	1.5	7.2	40.0	21.1	5.0	33.3	40
4	*Sarcococca saligna* (D.Don) Muell.	6	0.6	2.9	30.0	15.8	3.8	22.4	30
Tree Layer									
1	*Pinus roxburghii* Royle	5	0.5	41.7	40.0	57.1	62.3	161.1	40
2	*Ailanthus altissima* (Miller) Swingle	7	0.7	58.3	30.0	42.9	37.7	138.9	30

Table 5.4 . Physiochemical analysis of Soil of Dhali Hills, Chakesar, District Shangla.

No	Sites	Altitude	Soil Temp.	Soil Color	Slope	Location	Habitat	Textural of soil	Soil pH	EC	Ex. Na	Organic matter	Nitrogen %	P	Ex. K
1	Samseer	1240	23	Brownish	35	S	Dry	Sandy clayey loam	6.9	0.06	0.5	0.37	0.023	7	130
2	Senkaray	1275	25	Whitish	30	E	Dry	Sandy loam	5	0.06	0.3	0.73	0.046	32	130
3	Dhali	1310	23-Jan	Brownish	45	E	Dry	Sandy loam	5.9	0.53	0.3	1.51	0.094	8	160

Table 5.5 Environmental variables of Dhali hills, Chakesar valley, District Shangla.

Stands	Locations	Altitude	Temperature(F)	PAR Light (µM/mΛ2S)	Leaf wetness (LW)	Solar rad (Wat/m2)	RH (%)	WND (Deg)	WNS (mph)
1	Samseer	1240	98.7	645	0	1441	62.4	289	5
2	Senkaray	1275	98.5	735	1	1720	62.5	272	10
3	Dhali	1310	98.2	845	0	1524	61.3	286	10

Table.5.6 Communities attributes of Dhali Hill Chakesar, District Shangla.

Site	Aspect	Stand	No of Plants	Sp. Richness	Diversity	MI	E
Dhali Hill	Spring	1	22	0.74	1.85	16.8	0.2
		2	19	0.454	2.335	40.5	0.29
		3	25	0.81	2.256	34.4	0.25
	Summer	1	22	0.86	2.6	26.8	0.21
		2	11	0.395	3.2	62.7	0.31
		3	16	0.675	2	43.1	0.49
	Winter	1	20	0.73	2.5	28.5	0.31
		2	5	0.25	1.5	74	0.25
		3	10	0.524	1	47	0

Table 5.7 Comparative indices of similarities between different seasons of Dhali Hills Chakesar Valley, District Shangla.

Spring Aspect			
Stand	A	B	C
A	0		
B	19	0	
C	25	26	0

Summer Aspect			
Stand	A	B	C
A	0		
B	18	0	
C	22	30	0

Winter Aspect			
Stand	A	B	C
A	0		
B	16	0	
C	27	53	0

Table 5.8 Degree of homogeneity of Dhali Hills, Chakesar Valley, District Shangla.

Stand	Spring Aspect	Summer Aspect	Winter Aspect
1	A > B < C < D ≤ ≥ E	A > B > C ≤ ≥ D ≤ ≥ E	A > B > C > D ≤ ≥ E
2	A > B < C = D > E	A < B > C < D > E	A < B < C < D > E
3	A < B > C > D < E	A < B > C > D < E	A < B > C < D > E

Table 5.9.1 Regeneration Capacity of Spring Flora of Dhali Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Ailanthus altissima* (Miller) Swingle	3	5						
2	*Celtis australis* Wild.		2						
3	*Diospyrus kaki* Linn.		1						
4	*Ficus palmata* Forssk.	1	1						
5	*Hedra helix* L.	2							
6	*Melia azadarichta* Linn.	3	3	1					
7	*Morus alba* Linn.			2	1				
8	*Pinus roxburghii* Sargent.	2	5	12	5	2			
9	*Pyrus pashia* Ham.		1						
10	*Salix tetrasperma* Roxb. Pl. Corom.	3	2	1					

Table 5.9.2. Regeneration Capacity of Summer Flora of Dhali Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Ailanthus altissima* (Miller) Swingle	22	7	2					
2	*Prunus armeniaca* Linn.		1						
3	*Celtis australis* Wild.	1	2						
4	*Melia azadarichta* Linn.		1						
5	*Ficus palmata* Forssk.		1						
7	*Pinus roxburghii* Sargent.	5	12	1	1				

Table 5.9.3. Regeneration Capacity of Winter Flora of Dhali Site,Chakesar Valley, District Shangla.

		Diameter in Range							
No	Plants	0-25	26-50	51-75	76-100	101-125	126-150	151-175	176-200
1	*Ailanthus altissima* (Miller) Swingle	16	11	4					
2	*Celtis australis* Wild.		1	1	1				
3	*Ficus palmata* Forssk.		1						
4	*Melia azadarichta* Linn.		1						
5	*Pinus roxburghii* Sargent.		7	9	1	1	1		
6	*Prunus armeniaca* Linn.		1						

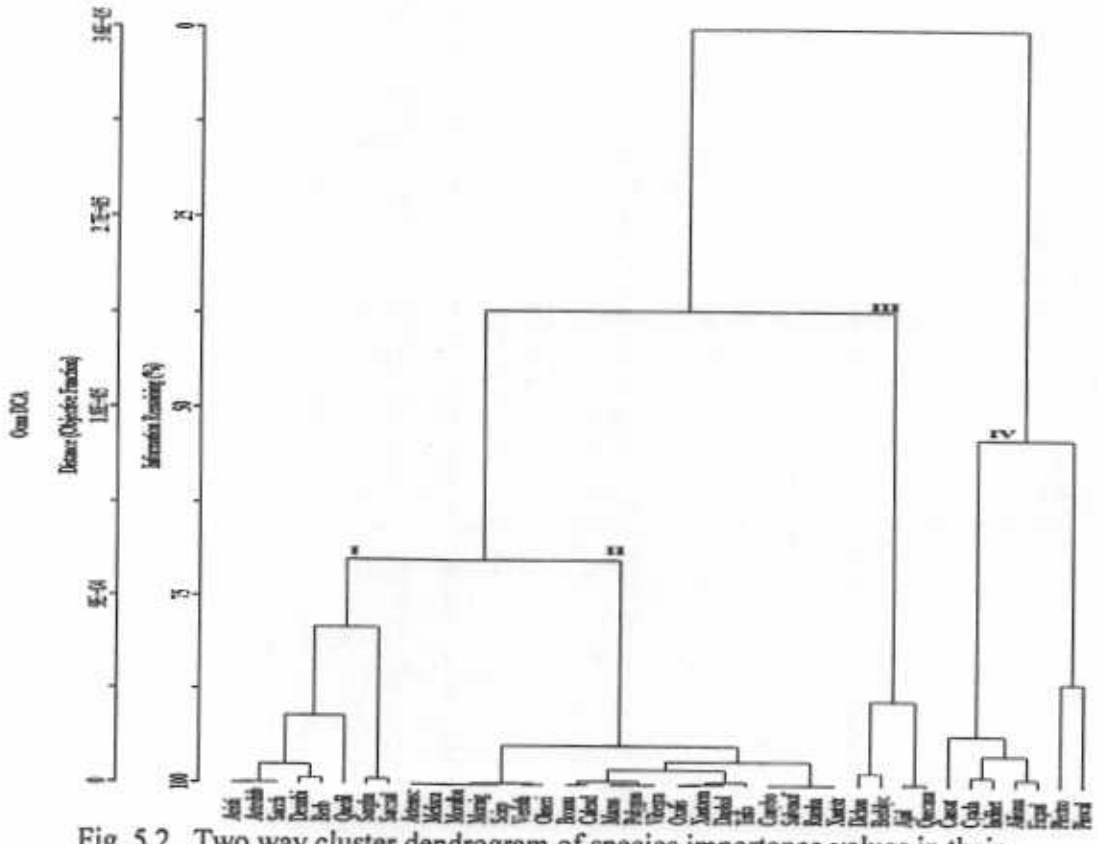


Fig. 5.2 Two way cluster dendrogram of species importance values in their stands in different aspect of the year.

```
                    1111222222 3  12212 123 11133
                   13490356013789622792625814054781 3

4   su             555545555555545555------5--------  00
7   wi             5555-555555555--55-4----5--55----  00
1   sp             ---2---------54-52355---5-5------  01
2   sp             ----------5-----554-555-------4--  01
3   sp             ---5---5------5-5523345-5-----5--  01
5   su             ------------5-5---------5----5555  1
6   su             -5---5--------555----5-5555---5-4  1
8   wi             ----------------5-------55-5-55-5  1
9   wi             ----------------------55-555-5-5  1

                   00000000000000000000001111111111
                   00000000000000011111110000001111
                   00000000000001100000011000011
```

Fig. 5.3 Two way indicator species analysis (TWINSPAN) of Dhali site.

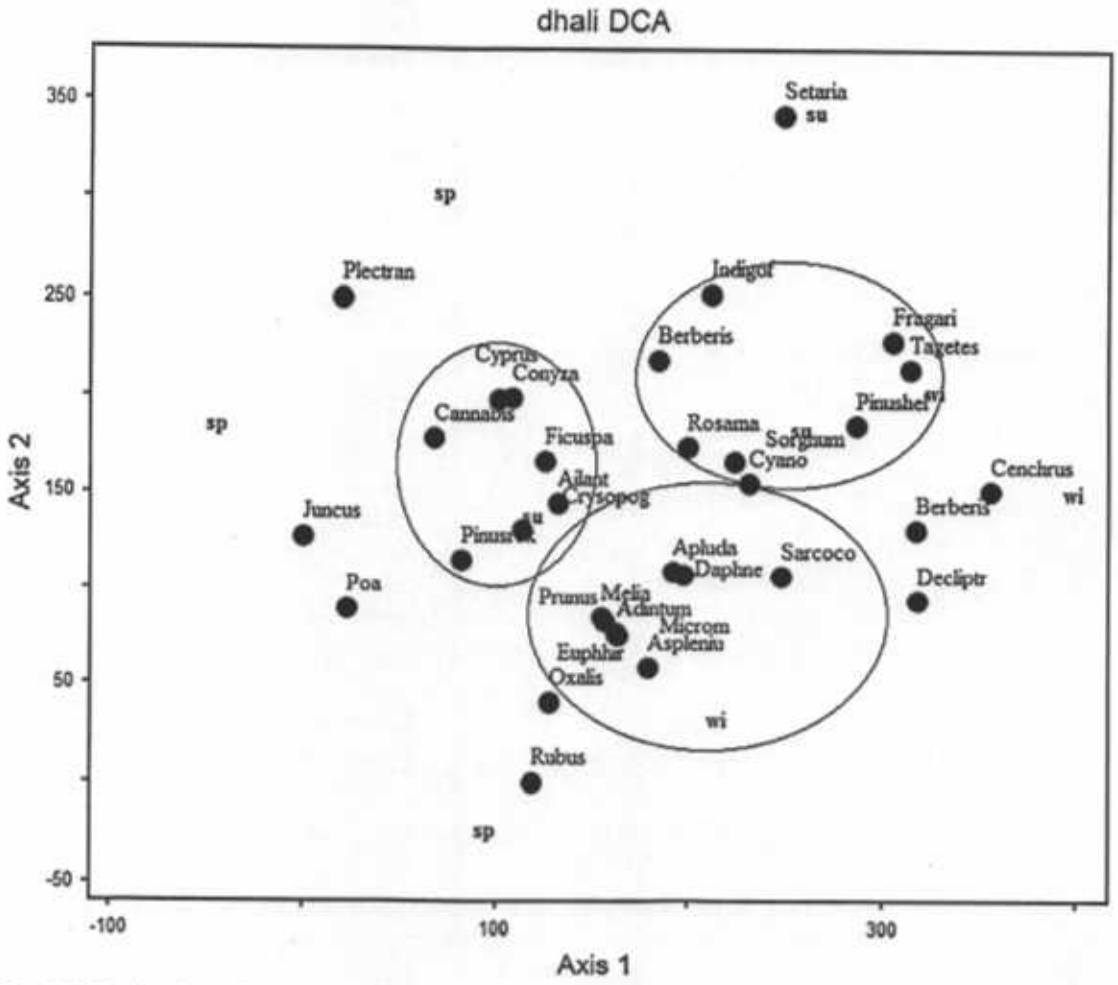


Fig. 5.4 Ordination diagram of description of plant communities of Dhali Hills as demarcated by DCA.

Appendices

Annexure 01

Used for Ethnobotany of medicinal plants

1. Name some of the medicinal plants.

   1)..... .2).....

   3)..... 4).....

   5)..... 6).....

2. Name the three best plants of your area.

   1) .....

   2) .....

   3) .....

3. Why it is considered that it is the best medicinal plant.

   1) ..... .2).....

   3)..... 4).....

   5)..... 5).....

4. Name the parts used.

   1) ..... .2).....

   3)..... 4).....

5. How local recipe is made.

   .....

   .....

6. Application and administration.

   .....

   .....

7. How the plant is collected?

   1) Whole plant 2) Roots/Rhizome

   3) Seeds 4) Leaves

8. Whether it is sold or used by you.

   1) Self use2) Purchase by the locals 3) Sold in the market

9. The plant is cultivated. Yes / No

10. The plant is Wild. Yes / No

11. Is there any ban on plant collection? Yes / No

12. Is there any Hakim in the area? Yes / No

Annexure 02

Used for Ethno ecology of Fodder Plants.

1. Name the plants used as fodder.
   1. ---------- 2. ----------
   3. ---------- 4. ----------
   3. ---------- 5. ----------
2. Enlist the best fodder plants
   1. ---------- 2. ----------
   3. ---------- 4. ----------
3. Why it is considered the best fodder Plant.
   1. ---------- 2. ----------
   3. ---------- 4. ----------
4. Animal preferences
   1. ---------- 2. ----------
   3. ---------- 4. ----------
5. Encircle the season availability.
   1. Summer 2. Winter 3. Spring 4. Autumn
6. Do people store it? Yes / No
7. Season of storage. A) Summer B) Winter C) Spring D) Autumn
8. How much quantity is stored?
   A) Summer---------- B) Winter ----------
9. Do you sell it? Yes / No
10. What is the price per local unit if sold in local market?

    .....

    .....

Annexure 03

For Ethno ecology of fuel wood

1. Name the plants used as fuel wood.

   1. ..... 2. .....

   3. ..... 4. .....

   5. ..... 6. .....

2. Name the best fuel wood in the above list.

   1. ..... 2. .....

   3. ..... 4. .....

3. Why it is considered the best fuel wood.

   1. ..... 2. .....

   3. ..... 4. .....

4. Bring from forest or purchase from market.

   1. Self collection 2. Market

5. What is the price per local unit if sold in local market?

   .....

1. Other sources of fuel wood.

   A) Kerosene oil B) Gas C) Electricity

7. Which of the following commonly collect the fuel wood?

   A) Male B) Female C) Children

8. How much distance you covered to collect fuel wood.

   1, 2, 3, 4, 5, 6, 7, 8 km.

9. Method of transportation.

   A) Head load B) Donkeys

   C) Horses D) Others

10. How much load you carry on Head. .....

11. How much time you take in carrying the loads in a day. (1), (2), (3), (4), (5) Hours

12. How much wood is consumed per month? .....

Annexure 04
Ethno ecology of Timber wood

1. Name the plants used as timber plants.

   1. ..... 2. .....

   3. ..... 4. .....

   5. ..... 6. .....

2. Name the three best timber wood species.

   1. .....

   2. .....

   3. .....

3. Why these are considered the best fuel wood.

   1. ..... 2. .....

   3. ..... 4. .....

   5. ..... 6. .....

4. Are you still using these timber woods? Yes / No

5. Is there any ban by Government/ Local community? Yes / No

6. Is there any protective measures taken by local communities? Yes / No

7. Is the best timber wood plant decreasing in the population? Yes / No

8. What do you consider causes of decline of this plant.

   1. .....

   2. .....

   3. .....

9. What do you recommend for conservation of plants of the area?

   1. .....

   2. .....

   3. .....

   4. .....

   5. .....

   6. .....

   7. .....

Annexure 05
Conservation status of Plants

Criterion for the Selection of Species

Local Name: .....B/Name .....

Availability

0=Uncommon or very rare
1=Less common or rare
2=Occasional
3=Abundant

Collection

0=More than 1000kg/yr
1=Consumed from 500-1000kg/yr
2=Consumed from 300-500kg/yr
3=Consumed from 100-200kg/yr

Growth

0=Regrowth in more 3 years
1=Regrowth within 3 years
2=Regrowth within 2 years
3=Regrowth within 1 year
4=Regrowth in a season

Part used

0=Root/Whole plant
1=Bark
2=Seeds, Fruits
3=Flowers
4=Leaves/Gum/Latex

Total Score

0-4 Endangered
5-8 Vulnerable
9-12 Rare
13-14 Infrequent
15-16 Dominant

.....+.....+.....+.....=.....

1-Endangered 2-Vulnerable 3-Rare 4- Infrequent 5-Dominant