Pak. J. Bot., 39(3): 679-690, 2007.

INDIGENOUS VEGETATION OF SOONE VALLEY: AT THE RISK OF EXTINCTION

KAFEEL AHMAD[1], MUMTAZ HUSSAIN[2], MUHAMMAD ASHRAF[2], MUHAMMAD LUQMAN[3], MUHAMMAD YASIN ASHRAF[4] AND ZAFAR IQBAL KHAN[1]

[1]Department of Biological Sciences, University of Sargodha, Pakistan.
[2]Department of Botany University of Agriculture, Faisalabad, Pakistan.
[3]University College of Agriculture,Islamia University Bahawalpur,
[4]Nuclear Institute for Agriculture and Biology, Faisalabad, Pakistan.

Abstract

This paper reports the results of the survey conducted to investigate the eco-geographic factors for *in-situ* conservation and description of location of various taxonomic and genetic diversity for the provision of critical assistance in the formulation of effective conservation campaign for target plant species near the point of extinction. A survey of the specific valley in mountaineous, region of Pakistan was performed on ten stuffy sites in the valley, selected on the basis of variation in their ecological parameters. Data were assembled on the leguminous plants, but some non-leguminous species were also included to work out frequency, density and coverage / dominance in particular area and status as well as diversity of leguminous plants was determined based on this information. The results obtained on the eco-geographical attributes were discussed in this study in terms of frequency, density, species dominance/percentage as well as relative frequency, relative density and relative coverage/dominance of the given area. A further correlation study with the various attributes regarding different study sites and distribution of species was also counted in this survey. For the effective planning for conservation of precious plant species, it is very essential to get the set of full information about eco-geographical attributes and threatening factors. Therefore the current research survey was conducted to acquire the informations regarding various parameters and threats and adaptations of present species to their environments. Results showed that most observed plant species in this specific valley may be due to some morphological and anatomical as well as physiological adaptations to this environment which is mainly responsible for their survival and perpetuation in this harsh habitat.

Introduction

Pakistan lies between 24°-37 North latitude and 61°-75.5 East longitude, covering an area of 796,095 sq. km. Out of this area 468, 000 sq. km is in the north and west in the form of mountainous land and plateau while the remaining 3,28,000 sq. km comprises the plains. Environmental variability in Pakistan is enormous, ranging from high snowy Himalayan peaks in the north to the hot humid climate of shores of the Arabian Sea in the south (Anon., 2006).

The mountain regions of Punjab, edges of Suleman range near Rajan pur have hot mountainous type vegetation (Chaghtai *et al*., 1983; Khan, 1991). Murree hills have sub-tropical pine forests and the higher elevations like Bhurban and Patriata favour the Himalayan moist temperate forests though, they are very limited. Margilla hills and Kalachitta hills have the sub tropical evergreen forests (Chaghtai *et al*., 1978).

The range of hills extending in an irregular arc from the Jehlum River on the East to the Indus River in the West constitutes this salt range covering a length of about 150 miles. It takes its name from the important salts deposits, which are being quarried at present at Khewora, Warchha and Kalabagh. The salt range is situated between longitude

71°-30 and 73°-30 East and between the parallels of 32°-23 and 33° North latitude. The average height of range is about, 2,200 ft. above sea level. The highest point on the range is Skasar (5,010 ft); through out its length the salt range shows a typical aspect of having steep cliffs to the south but, descending gently to the plateau to the north (Ahmed, 1964).

In the heart of this range lies the Soone valley. The climate of valley is characterized by a relatively low annual precipitation (20 inches) and average minimum temperature is 1^0C (January) while average maximum temperature is 36^0C (June). Hot dry winds and prolonged periods of drought are frequent; winters are accompanied by frost. Summer and winter, both are cooler than those of adjoining plains and the winter season is also longer than that in plains (Hussain, 2002).

Biodiversity is a key feature of properly functioning grazed ecosystem. Legumes are one of the keystone plant species in productive grass lands (Sanderson *et al.,* 2002). Communities are recognized with differing floristic and environmental characteristics; plots from each of these communities are viewed in winter as well as in spring to gain insight into the vegetation (Bezuidenhout & Breden-Kamp, 1990; Kirk-Patrick, 1990; Smitheman & Perry, 1990).

The vegetation of salt range comprises both legumes and non legumes (Ahmed, 1964; Hussain, 2002). Legumes have the capacity to capture nitrogen from the soil atmosphere; this allows pastures and crops to maintain productivity without depletion of soil nitrogen and some times can grow under situations where soil nitrogen levels are very low and where growth of other plant would not be possible. Further more, when legume plants die, its organic matter is broken down; there is usually a net gain in organic nitrogen to the soil (Graham, 1992; Pearson *et al*., 1993).

It is reported that leguminous species tolerate the drought due to the presence of nodules; however, the tolerance limit of the species depends on the nodule size. Initially nitrogen fixation decreased in response to water deficit prior to many other physiological processes and soil nitrogen accumulation (Andyking & Purcell, 2001).

Little is known about the geological history of the salt range vegetation; fossil records indicate that the angiosperms date back to the tertiary period while pre tertiary fossils have no angiosperm affinities (Hussain, 2002). The vegetation of the Soone valley is under the division "Sub-tropical dry evergreen forests". *Olea ferruginea* Royle and *Acacia modesta* Wall are recorded to be two characteristic trees of the area (Champion, 1936). Due to heterogeneity in the macro and microenvironment of the valley large plant and animal diversity is expected to be endemic to it (Hussain, 2002; 2003).

Scanty reports are available about the vegetation of this region. According to Ahmed (1964) the vegetation of plains of salt range (Soone Valley) consists of an open low forest in which Thorny usually hard woody species pre-dominate. The trees usually have short trunks and low branching crowns. The dominants vary from 12-20 feet in height and tend to be longer at elevation. However, higher altitude favorably affects the size and percentage cover of the plants. *Olea-pistacia* association has been reported as the climax vegetation of the salt range (Hussain, 2003).

Eco-geographic studies are an essential component of any *In-situ* conservation programme, not only because the studies describe the location of taxonomic and genetic diversity, but also provide critical assistance in the formulation of appropriate and effective conservation programme for target plant species.

In order to assess the present status of leguminous diversity of this valley, the work was undertaken to explore the diversity and status of available leguminous species particularly and generally non-leguminous plants.

Materials and Methods

Vegetation of Soon Valley (Punjab) was ecologically studied during 2002 and 2003 to understand the present status of the vegetation. Field survey of valley was performed for the accomplishment of said objective, which comprised of the following three aspects.

i. Selection of sites
ii. Collection of data
iii. Analysis of data

Site selection: On the findings of a preliminary survey (Fig. 1), ten study sites viz., Anga Site, Champal site, Dape sharif site, Khabeki Site, Knotty Garden site, Khoora site, Noshera (vicinity) site, Skasar (vicinity) site, Sodhi Site and Ucchali Site were selected mainly on the basis of variation in their ecological attributes, especially topography, vegetation type and soil composition. The ecological attributes of each study site are given in (Table 1).

Data collection: For each site data were collected from three different habitats, considering differences in their elevation, ground position and soil type. Data were collected by quadrate method. Ten randomly selected quadrates measuring 10 m^2 for woody species and 1 m^2 for herbaceous plant species were taken from each habitat. The number of individuals of each leguminous, as well as, non-leguminous species was counted to work out the under mentioned parameters.

1. Species frequency
2. Species density
3. Coverage/ Dominance

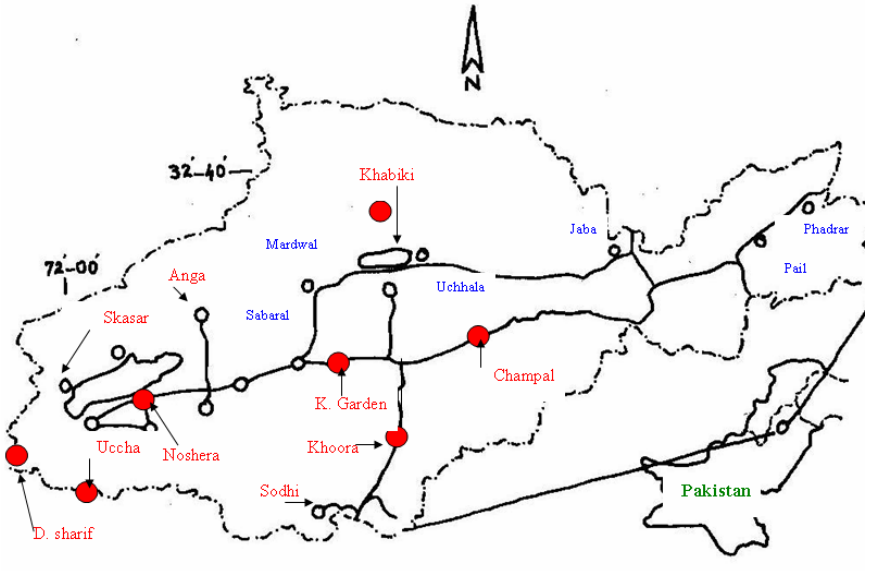

Fig. 1. Location of selected sites from Soone Valley.

Table 1. Ecological parameters of ten vegetation sampling sites in Soone valley, Pakistan.

Site name	Elevation (m)	Slope %	Aspect	Soil texture	Moisture contents %	EC dS/m	pH	N (mg/g)	P (mg/g)	K (mg/g)	Habitat description	Vegetation type	Plant community
Anga	821	30-35	Northern	Sand stone with clayed sand	10.51	2.37	7.80	128.42	94.64	68.11	Hills with steep slopes	Dominant grasses & shrubs	*Olea ferruginea-Dodonea viscoa*
Champal	637	60	East-western	Sand stone, lime stone	8.19	2.46	8.78	131.09	89.32	64.98	Inside the valley	Dominant herbs with grasses & few shrubs	*Acacia modesta*
Dape Shaif	890	40	Western	Sandy clay	7.64	1.99	8.32	101.74	88.54	61.44	Within the valley	Dominant grasses with herbs	*Acacia modesta*
Khabeki	774	60	Western	Sandy clay	12.46	1.10	7.14	99.31	90.79	61.68	Moderate slopes	Dominant large shrubs with grasses	*Adhatoda vasica*
Khoora	866	45	Northern	Red sandy clay with sand stone	7.09	3.11	7.96	108.61	90.62	69.99	Hills with steep slope	Small shrubs & herbs with grasses	*Dodonea viscoa*
K. Garden	783	30-35	Northern	Sandy clay	8.19	1.49	7.89	111.52	90.23	64.32	Hills with less steep slopes	Mixture of grasses & herbs	*Adhatoda vasica-Acacia farnesiana*
Noshera	686	0-10	South-western	Mostly sand stone	6.83	3.59	8.01	117.32	88.76	61.00	Plain surface in the periphery	Mixture of grasses and herbs	*Dodonea viscoa*
Skasar	790	40-45	Western	Sandy clay	10.11	1.28	7.39	100.59	82.02	62.16	Top of the hill where surface was more or less flattened	Sedges and small shrubs	*Dodonea viscoa*
Sodhi	632	15	Northern	Lime stone, sand stone	7.51	2.14	8.36	116.64	88.73	58.00	More or less flattened peripheral area	Dominant grasses with large and medium shrubs	*Dodonea viscoa*
Uechali	686	30	Southern	Lime stone with sand stone	11.00	2.78	7.83	99.12	88.11	60.12	Uneven peripheral area	Dominant grasses with large herbs and trees	*Acacia modesta*

From above information the following attributes were worked out and the status of available leguminous species were determined:

1. Relative frequency
2. Relative density
3. Relative coverage/ Dominance
4. Importance value

Following formulae were used to calculate the values:

$$\text{Frequency \%} = \frac{\text{Number of quadrates in which a species occurred}}{\text{Total number of quadrates taken}} \times 100$$

$$\text{Density \%} = \frac{\text{Total number of individuals of a species in a quadrate}}{\text{Total number of individuals of all the species in a quadrate}} \times 100$$

$$\text{Coverage/dominance\%} = \frac{\text{Area covered by a species in a quadrate}}{\text{Total area covered by all the species}} \times 100$$

$$\text{Relative frequency\%} = \frac{\text{Frequency value of a particular species}}{\text{Total frequency values for all the species}} \times 100$$

$$\text{Relative density\%} = \frac{\text{Density of a particular species in a site}}{\text{Total density for all the species in that site}} \times 100$$

$$\text{Coverage/dominance \%} = \frac{\text{Coverage/dominance of a particular species}}{\text{Total coverage/dominance for all the species within a stand}} \times 100$$

Importance value = Relative density + relative frequency +relative coverage

Classification of species: Available Leguminous species were classified by using the following frequency ranges (Table 2).

Table 2. Frequency ranges for classification of species.

Frequency range (%age)	Category	Symbol
1-20	Rare	R
21-40	Occasional	O
41-60	Frequent	f
61-80	Abundant	A
81-100	Very abundant	V.A

Results

Species frequency percentage: The six species differed significantly however, *Acacia modesta* was species which surpassed all of other five (Table 4). It scored the highest value of (64%) followed by *Acacia farnesiana* (42%). *Dalbergia sissoo, Medicago polymorpha, Melilotus indica* and *Vicia sativa* showed non-significant differences both from *Acacia modesta* and *Acacia farnesiana*.

Correlation among soil characteristics and species frequency showed that only pH value of soil had positive and significant relationship which means that pH played a significant role in the establishment of species in the particular site especially in case of *Acacia farnesiana* (Table 5).

Species density percentage: The data have clearly indicated that species density varied ($p>0.05$ or 0.01 or 0.001) significantly varied at all study sites (Table 4). *Acacia farnesiana* showed maximum value but it differed non-significantly to that of *Acacia farnesiana, Medicago polymorpha* and *Vicia sativa*. Lowest value (1.28%) was calculated for *Dalbergia sissoo* showing significant variation with *Acacia modesta* and *Acacia farnesiana* but exhibited non-significant differences with remaining three species. As observed in correlation studies (Table 5) that only two species i.e. *Melilotus indica* had significant positive behavioral relationship with nitrogen content of soil while *Acacia farnesiana* indicated significant positive results towards pH value of soil.

Species coverage percentage: Coverage of species revealed that all the species varied ($p<0.05$) significantanly (Table 4). *Acacia modesta* attained the highest value (64.6%) followed by *Acacia farnesiana* (47.2%). The differences among *Dalbergia sissoo; Medicago polymorpha; Melilotus indica* and *Vicia sativa* were statistically ($p>0.05$) non significant.

Correlation has shown species coverage percentage and different species showed that *Melilotus indica*; *Vicia sativa* and *Medicago polymorpha* shared highly significant negative relationship with respect to phosphorus concentration in the soil (Table 5).

As for as EC of soil was concerned *Acacia farnesiana* showed significant negative correlation, while *Acacia farnesiana* and *Dalbergia sissoo* had significant positive correlation with moisture contents of soil for this particular attribute.

Species relative frequency percentage: All the species differed ($p<0.05$) significant for species relative frequency percentage (Table 4). *Acacia modesta* showed maximum value (9.67%) and shared non-significant ($p>0.05$) differences only with *Acacia farnesiana* but differed ($p<0.01$) significantly with *Dalbergia sissoo, Medicago polymorpha, Melilotus indica* and *Vicia sativa*. Correlation studies of this parameter (Table 5) towards soil attributes showed non-significant ($p>0.05$) relationship.

Species relative density percentage: The data presented in Table 4 shows that the species had significant ($p<0.01$) differences for relative density percentage. *Acacia modesta* among woody legume species showed maximum value and shared non-significant ($p>0.05$) difference with only *Acacia farnesiana* and significant for other remaining four species. Although significant difference between *Acacia farnesiana* and *Dalbergia sissoo* but exhibited different response regarding *Medicago polymorpha*; *Melilotus indica* and *Vicia sativa.* All these species showed non significant ($p>0.05$) differences and also with *Acacia farnesiana*.

Table 3. Available leguminous species indigenous to Soone Valley, Punjab, Pakistan.

Species name	Family
Acacia farnesiana	Mimosaceae
Acacia hydaspica	Mimosaceae
Acacia modesta	Mimosaceae
Acacia nilotica	Mimosaceae
Albizzia lebbeck	Mimosaceae
Argyrolobium stenophyllum	Papilionaceae
Dalbergia sissoo	Papilionaceae
Medicago laciniata	Papilionaceae
Medicago polymorha	Papilionaceae
Mellilotus alba	Papilionaceae
Mellilotus indica.	Papilionaceae
Prosopis glandulosa	Mimosaceae
Prosopis juliflora.	Mimosaceae
Prosopis spicigera	Mimosaceae
Rhyncohsia minima	Papilionaceae
Sophora mollis	Papilionaceae
Trigonella monantha	Papilionaceae
Vicia monantha	Papilionaceae
Vicia Sativa	Papilionaceae

Significant negative correlations between *Medicago polymorpha* and *Melilotus indica* soil phosphorus content and *Melilotus indica* EC of the soil showed significant negative correlations with relative density percentage in case of *Vicia sativa* (Table 5).

Species relative coverage/dominance percentage: Significant differences were ($p<0.05$) recorded between species relative coverage/dominance and species (Table 4). The studied species showed different behaviour to one another. *Acacia modesta* showed the maximum value followed by *Acacia farnesiana* but the difference between them was non significant ($p>0.05$), however both species showed significant differences with remaining four species i.e., *Dalbergia sissoo, Medicago polymorpha, Melilotus indica* and *Vicia sativa*. All the remaining four species showed non-significant ($p>0.05$) differences with one another as indicated in Table 5. The data regarding correlation studies, *Medicago polymorpha* showed highly significant negative relationship with phosphorous content of soil. Whereas significant negative and significant positive correlation with EC and pH of soil respectively for this species. *Dalbergia sissoo* and *Melilotus indica* showed significant positive and significant negative relationships regarding moisture and phosphorous contents of soil respectively.

Species importance value (RF+RD+RC): As indicated in Table 4 each species possessed significance values for species importance. *Acacia modesta* showed maximum value (31.67) followed by *Acacia farnesiana* (26.03) and differences were statistically non significant ($p>0.05$) with one another. *Vicia sativa, Medicago polymorpha, Melilotus indica* and *Dalbergia sissoo* differed non-significantly for species importance. But they differed significantly ($p<0.01$) with *Acacia farnesiana* and *Acacia modesta*.

Table 4. Analysis of variance.

Source of variation	Degree of freedom	Frequency (%)	Density (%)	Coverage/ dominance (%)	Relative frequency (%)	Relative density (%)	Relative coverage/ dominance (%)	Importance value (RD + RF + RC)
Species	5	1637.400**	56.530**	2989.700**	41.838**	68.930**	121..790**	662.930**
Error	35	421.400	13.030	329.100	9.670	16.090	10.440	82.350
Species				(Mean ± SEM)				
A. farnesiana		42.0 ± 11.6ab	8.90 ± 2.84a	47.2 ± 11.9ab	7.10 ± 2.12ab	8.84 ± 2.83ab	10.09 ± 2.75a	26.03 ± 7.43a
A. modesta		64.0 ± 5.48a	8.01 ± 0.90a	64.6 ± 6.88a	9.67 ± 0.78a	9.43 ± 1.07a	12.32 ± 0.86a	31.67 ± 1.96a
D. sissoo		20.0 ± 3.65b	1.28 ± 0.35b	10.2 ± 1.96b	2.81 ± 0.58c	1.37 ± 0.40c	1.81 ± 0.41b	6.13 ± 1.22b
M. polymorpha		40.0 ± 9.20b	5.30 ± 1.81ab	28.1 ± 8.17b	5.54 ± 1.45bc	4.18 ± 1.69bc	4.94 ± 1.51b	14.67 ± 4.18b
M. indica		33.7 ± 10.8b	2.48 ± 0.67b	21.8 ± 4.94b	5.01 ± 1.64bc	4.27 ± 1.80bc	3.74 ± 0.87b	13.06 ± 3.76b
V. sativa		41.0 ± 6.73b	5.18 ± 1.26ab	27.6 ± 4.28b	5.41 ± 0.60bc	4.21 ± 1.36bc	5.09 ± 0.76b	14.70 ± 2.35b

NS = Non-significant ($p<0.05$); * = Significant ($p<0.05$); ** = Highly significant ($p<0.01$)
SEM = Standard error of mean
Means sharing similar letters in a column are statistically non-significant (p>5%).

Table 5. Correlation analysis.

Parameter	Species	Elevation	N	P	K	EC	pH	Moisture
Frequency (%)	*A. farnesiana*	-0.407	-0.147	0.421	-0.512	-0.767	0.931*	0.784
	A. modesta	0.549	-0.042	0.126	0.521	-0.698*	0.259	0.160
	D. sissoo	0.059	-0.188	0.292	0.423	-0.236	0.074	0.298
	M. polymorpha	0.474	-0.412	-0.566	0.128	-0.718	0.302	-0.118
	M. indica	0.565	-0.506	-0.557	0.249	-0.746	0.408	0.117
	V. sativa	0.143	-0.507	-0.133	-0.660	0.300	-0.281	0.123
Density (%)	*A. farnesiana*	-0.248	-0.265	0.691	-0.278	-0.595	0.878*	0.787
	A. modesta	0.414	-0.550	0.169	0.202	-0.157	0.084	0.606
	D. sissoo	-0.438	0.269	-0.087	0.452	0.310	0.028	0.480
	M. polymorpha	0.140	-0.112	0.263	0.073	-0.275	-0.264	-0.273
	M. indica	-0.357	0.834*	0.380	0.214	0.492	-0.381	-0.351
	V. sativa	0.250	-0.216	-0.498	-0.277	-0.207	0.110	0.029
Coverage / dominance (%)	*A. farnesiana*	-0.643	0.068	0.378	-0.474	-0.929*	0.952	0.876*
	A. modesta	0.046	-0.083	-0.154	0.162	-0.484	0.265	0.310
	D. sissoo	-0.337	-0.213	0.346	0.072	-0.177	0.548	0.906*
	M. polymorpha	-0.105	-0.337	-0.917**	-0.446	-0.694	0.722	0.229
	M. indica	0.135	-0.346	-0.851*	-0.548	-0.236	0.242	0.505
	V. sativa	0.134	-0.233	-0.804*	-0.152	-0.504	0.454	0.000
Relative frequency (%)	*A. farnesiana*	-0.223	-0.075	0.660	0.003	-0.354	0.783	0.412
	A. modesta	0.133	0.434	0.285	0.652	-0.289	0.156	-0.123
	D. sissoo	-0.128	0.160	0.434	0.643	-0.273	0.151	0.261
	M. polymorpha	0.359	-0.309	-0.625	0.223	-0.784	0.448	-0.032
	M. indica	0.385	-0.276	-0.615	0.293	-0.819	0.513	0.167
	V. sativa	-0.217	-0.421	-0.243	-0.596	-0.035	0.185	0.420
Relative density (%)	*A. farnesiana*	-0.231	-0.286	0.727	-0.254	-0.583	0.863	0.811
	A. modesta	-0.160	0.011	0.112	0.250	0.005	-0.090	0.526
	D. sissoo	-0.447	0.180	-0.176	0.360	0.313	0.043	0.518
	M. polymorpha	0.057	-0.322	-0.981**	-0.023	-0.626	0.524	0.281
	M. indica	0.005	-0.083	-0.908*	-0.273	-0.638	0.566	0.430
	V. sativa	-0.327	0.007	-0.439	-0.026	-0.753*	0.849	0.491
Relative coverage / dominance (%)	*A. farnesiana*	-0.318	0.026	0.648	0.032	-0.403	0.819	0.406
	A. modesta	-0.206	-0.043	-0.133	0.210	-0.484	0.467	0.507
	D. sissoo	-0.374	-0.263	0.187	-0.002	-0.145	0.526	0.902*
	M. polymorpha	-0.154	-0.362	-0.914**	-0.423	-0.767*	0.755*	0.315
	M. indica	-0.033	-0.353	-0.918**	-0.560	-0.386	0.441	0.718
	V. sativa	-0.070	-0.310	-0.734	-0.229	-0.627	0.759	0.421
Importance value (RD + RF + RC)	*A. farnesiana*	-0.269	-0.120	0.705	-0.084	-0.472	0.855	0.576
	A. modesta	-0.121	0.130	0.032	0.466	-0.389	0.283	0.476
	D. sissoo	-0.278	0.043	0.274	0.475	-0.122	0.244	0.554
	M. polymorpha	0.093	-0.369	-0.948**	-0.084	-0.806*	0.643	0.217
	M. indica	0.157	-0.234	-0.913*	-0.130	-0.749	0.595	0.443
	V. sativa	-0.268	-0.205	-0.555	-0.243	-0.649	0.786*	0.530

Correlation studies (Table 5) revealed that *Medicago polymorpha* shared highly significant negative correlation with phosphorus content of soil while significant negative correlation with EC of soil. *Melilotus indica* showed significant negative correlation with soil phosphorus, on the other hand *Vicia sativa* possessed positive correlation with soil pH value.

Discussion

For the formulation of an effective plan for *ex-situ* and *in-situ* conservation species, it is very necessary to get the true picture of species; information about habitat, ecological factors and the disturbing factors prevailing there. Therefore the present studies were

conducted on the vegetation of Soone valley and the above mentioned results were obtained for the assessment and current status of species indigenous to this particular region, above described observation were used to evaluate soil and vegetation degradation (Dalsted, 1988). Species importance values were calculated from plots for their density and frequency values as indicated by McDowell *et al.,* 1983. The species were described in terms of rare, vulnerable and endangered. In the present studies the frequency and density values of species were calculated by using quadrate method, these results are in line with those obtained by Sharma *et al*., (1983) while working on forest vegetation and classification survey studies.

The interpretations has been made on the basis of relationship between vegetation types, elevation, soil composition and soil mineral contents which are mostly used informative criteria to describe the plant diversity of a particular area.

To make the study more scientific and representative of that particular site, the observations were made for vegetation types, soil characteristics and different plant communities existed at various heights. The study of seasonal variation in plant diversity is also necessary to estimate the importance of the plant community. Therefore sites were viewed in spring as well as in winter to figure out plant communities existed in these seasons. Similarly the environmental factors affecting the vegetation, the moisture level of soil were the primary determinant of plant growth and distribution which in turn are controlled by soil composition, soil types, and mineral nutrients of soil and topography were also recorded for the particular selected sites. The findings of the present study are in agreement to the findings of some earlier researchers (Sharma *et al.,* 1983; Austin & Heyligers, 1989; Kirk-Patrick, 1990), in different regions of the world.

Table 6. Classification of available leguminous species indigenous to Soone Valley, Punjab, Pakistan.

Species name	Family	Category
Acacia farnesiana	Mimosaceae	Frequent
Acacia hydaspica	Mimosaceae	Rare
Acacia modesta	Mimosaceae	Very Abundant
Acacia nilotica	Mimosaceae	Rare
Albizzia lebbeck	Mimosaceae	Occasional
Argyrolobium stenophyllum	Papilionaceae	Rare
Dalbergia sissoo	Papilionaceae	Frequent
Medicago laciniata	Papilionaceae	Abundant
Medicago polymorha	Papilionaceae	Rare
Mellilotus alba	Papilionaceae	Rare
Mellilotus indica.	Papilionaceae	Frequent
Prosopis glandulosa	Mimosaceae	Rare
Prosopis juliflora.	Mimosaceae	Rare
Prosopis spicigera	Mimosaceae	Rare
Rhyncohsia minima	Papilionaceae	Rare
Sophora mollis	Papilionaceae	Rare
Trigonella monantha	Papilionaceae	Rare
Vicia monantha	Papilionaceae	Rare
Vicia Sativa	Papilionaceae	Abundant

Results obtained on the various parameters for species importance studied in this valley frequency (6.66-90.00), density (0.55-13.00), coverage (7.00-84.00), relative frequency (0.05-2.93), relative density (0.09-15.38), relative coverage (0.66-17.39) and importance values (1.62-39.87) respectively from ten ecologically diverse sites corroborated with the work on some earlier researchers like Austin & Heyligers, (1989) and Kirk-Patrick (1990). Smitheman & Perry(1990) who supported the above criteria and described plant communities of different areas of the world. In the present investigation all the observed species were classified according to their frequency ranges. *Acacia modesta* was the only very abundant species followed by *Medicago laciniata* and *Vicia sativa* both of which were under the category of abundant. *Acacia farnesiana, Dalbergia sissoo* and *Melilotus indica* were frequent species of the valley *Albizzia lebbeck* was the only occasional species of this region. Remaining twelve species viz., *Acacia hydaspica, Acacia nilotica, Argyrolobium stenophyllum, Medicago polymorpha, Melilotus alba, Prosopis glandulosa, Prosopis Juliflora, Prosopis spicigera, Rhyncohsia minima, Sophora mollis, Trigonella monantha* and *Vicia monantha* can be placed in the category of rare. The criteria of classification fixed in the present study was strongly supported by the findings of Hussain, (2002) from Pakisan.

The species variation in plants from site to site may be due to the soil type, composition of soil; elevation of selected sites; moisture content of soil; Nature of disturbance like grazing pressure; human interference, distance of study site from population area etc. All these factors determine the category of species in which the species fall. From the results it can be concluded that *Acacia modesta* is the most abundant species in the Soone valley that may be due to its adaptation to the environment and osmotic adjustment to various types of environments under both winter and summer season; This species was found to be most successful in maintaining its high diversity that may also be due to its strong root system, as a result of which it may be able to absorb the nutrients from different depth and from different type of soil. Similar observation were also reported by Ahmad, (2002) and Hussain (2002, 2003) in Pakistan while working on exploration of vegetation indigenous to Soone Valley.

References

Ahmad, Z. 2002.Conservation of wild life and its habitat in Soan valley. *Tiger Paper*, 29(l): 12-16.

Ahmed, I. 1964. Vegetation of the salt range. *The Pak. J. Forestry*, (I): 36-64.

Andyking, C. and L.C. Purcell. 2001. Soybean nodule size and relationship to nitrogen fixation response to water deficit, *Crop Sci*., 41: 1099-1107.

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

Austin, M.P and P.C. Heyligers. 1989. Vegetation survey design for conservation: gradsect sampling of forests in north-eastern new south wales. *Australian developments in conservation evaluation*. (Ed.): C.R.J. Margules. Biological conservation, 50(1-4): 13-32.

Bezuidenhout, H. and G.J. Bredenkamp. 1990. A reconnaissance survey of the vegetation of the dolomitic region in the potchefstroom ventersdorp, Randfontein area South Africa. *Phytocoenologia*, 18(2-3): 387-403.

Chaghtai, S.M., N.A. Rana and H.R. Khattak. 1983. Phytosociology of the Muslim graveyards of Kohat Division, NWFP, Pakistan. *Pak. J. Bot*., 15(2): 99-108.

Chaghtai, S.M., S.H. Shah and M.A. Akhtar. 1978. Phytosociological studies of the graveyars of Peshawar district, NWFP. *Pak. J. Bot*., 10: 17-30.

Champion, H.G. 1936. A preliminary survey of the forest types of India and Burma. *Ind. For. Rec. New ser*. (silv)., 1.

Dalsted, K.J. 1988. The use of land-sat based soil and vegetation survey and graphic information system to evaluate sites for monitoring desertification. *Desertification Control Bulletin*, 1(16): 20-26.

Dyksterhuis, E.J. 1949. Conditions and management rangeland based on Quantitative Ecology. *Tour. Range Management*, 2: 104-115.

Graham, P.H. 1992. Some problems of nodulation and symbiotic nitrogen fixation in *Phaseoulus vulgaris* L. A, review. *Field Crop Res*., 4: 93.

Hanson, W.R. l951. Conditions classes on mountain range in southern Alberta. *Tour. Range Management*, 4: 165-170.

Hussain, I. 1968. The canopy coverage method for the determination of range conditions. *Division of Forestry Research Leaflet*., (110): 2.22 P. PFI. Peshawar.

Hussain, M. 2002. *Exploration of legume diversity endemic to salt range in the Punjab*. Annual technical report submitted to University of Agriculture, Faisalabad, Pakistan.

Hussain, M. 2003. *Exploitation of forage legume diversity endemic to Soone Valley in the Salt Range of the Punjab*. Annual technical report submitted to PARC, Islamabad, Pakistan.

Khan, M.H. 1991. Phytosociolgoical studies of suleman mountains in Balochistan. *Pak. J. For*., 41(1): 14-19.

Kirk-patrick, A.H. 1990. A vegetation survey of heath and moorland in northern Ireland and co. congeal. *Dissertation abstracts international-B, Sciences and Engineering*, 51(2): 544b.

McDowell, B., J. Newman and J. Ebinger. 1983. Survey of the woody vegetation of the Kankakee sand area section of Indiana and Illinois. *Proceedings of the Indiana Academy of Science*., 93: 187-193.

Mulder, C.P.H., A. Jumpponen, P. Hogherg and K. Huss-Danell. 2002. How plant diversity and legume affect nitrogen dynamics in experimental grass land communities. *Occologia*., 133(3): 412-421.

Pearson, C., G. Cunningham and D. King. 1993. *A plain English guide to Agriculture plants.* Longman Cheshive (Ltd). Melborne. 3205, Australia.

Sanderson, M.A., F. Taube, B. Tracy and M. Wachendorf. 2002. Plant species diversity relationship in grassland of the northeastern USA and northern Germany. Multi-function grasslands: quality forages, animal products and landscapes. *Proceedings of the 17th General meeting of the European grassland Federation, La Rochelle, France*, 27-30 May, 2002: 842-843.

Sharma, S.K., M. George and K.G. Prasad. 1983. Forest vegetation survey and classification with special reference to south India. 1. Vegetation survey and Quadrat analysis, *Indian forester*, 109(6): 384-394.

Smitheman, J. and P. Perry. 1990. A vegetation survey of the karoo national botanic garden reseve Worcester. *South African J. of Botany*, 56: 525-541.

Wacquant, J.P., M. Ouknider and P. Jacquard. 1989. Evidence for a periodic excretion of nitrogen by roots of grass-Legume association. *plant and soil*, 116(1): 57-68.

(Received for publication 26 January 2007)