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PHYTOSOCIOLOGICAL STUDY OF THE GRAVEYARDS OF PESHAWAR DISTRICT, NWFP, PAKISTAN

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Abstract

The vegetation of the graveyards of the district of Peshawar, NWFP, Pakistan was sampled and analyzed. A comparision of the amounts of available Na, K, Ca, NO3 and PO4 in the soils of the graveyards and the adjacent wild-lands was made. The soil of the graveyards was rich in Ca and PO4. The number of species in a community was found to be limited by the degree of salinity. The texture and the amount of CaCO3 in the soil govern the dominants of the community.

Introduction

In view of the dearth of protected areas in Pakistan, muslim graveyards provide an excellent opportunity for the study of comparatively less disturbed vegetation of the area. Stewart (1955) and Champion *et al* (1965) consider these graveyards ideal for the study of the natural flora of the region. The decay of the human bodies adds to the nutrients of the soil. The plant communities of the graveyards are not only the manifestation of the protected conditions but also that of the additional nutrients released by the decaying bodies.

A representative sample of the graveyards of the district of Peshawar was obtained. Of the four graveyards selected for this purpose, three were located in Peshawar Tehsil and one in Tehsil Nowshera. The degree of protection and easy access to the area were the two factors on the basis of which the graveyards were selected for this study. The study was conducted in the summer of 1976 and thus it covers the summer flora only.

Geology and Soil

The district of Peshawar lies between longitudes 71° 25' and 72° 15' east and 33° 40' and 34° 25' north latitudes (Cobb, 1931). It is situated in the saucer-shaped Peshawar Basin formed by the Kabul River and its tributaries (Dichter & Popkin, 1967). The Peshawar Basin is the most distinct physiographic region and sits roughly in the centres of the province of NWFP. In the geological past, Peshawar Basin was a bed of a vast lake bounded by the surrounding hills and fed by rivers which now flow through its formerly subaqueous bed (Rashid, 1961). Structurally it has not been determind whether or not the basin was produced by faulting or by down-warping. However, according to Coulson (1941) the tremendous weight of the detritus and sediment poured on to it in the pleistocene period may have been heavy enough to depress its valley floor. Larger parts of the Tehsils of Peshawar and

TABLE 1. Average of mean maximum, mean minimum temperatures (C°); rainfall (mm); and relative humidity (per cent) recorded at Peshawar (Elevation=359 m) for a period of 7 years (1966-73).

(Courtesy of the Department of Watershed Management, Pakistan Forest Institute, Peshawar)

Months	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total Annual
Max. Temp.	17.3	17.2	23.9	29.1	34.4	39.3	37.3	35.3	32.9	30.1	34.8	19.5	—
Min. Temp.	2.0	4.5	9.7	14.1	18.0	24.5	26.0	25.2	21.5	13.6	6.7	2.8	—
Rainfall	19.3	42.9	79.9	46.2	21.9	4.9	20.2	29.8	22.6	16.5	15.4	11.9	331.5
R. Humidity	63.5	58.7	57.4	50.9	37.9	38.0	53.1	62.1	55.5	49.1	54.0	62.2	—

Results

Coummunity Characteristics :

On the basis of importance values, four communities were constituted. Naugaza stand supported *Cynodon-Prosopis* community. This community is sufficiently protected because of a boundry wall around the graveyard. The soil is silty-clay, non-saline and strongly calacareous (Tables 2& 3). Tehkal had *Cynodon-Capparis* community. The stand is located on a raised land. The soil is silty-clay loam and a bed of nodular limestone which were called *kankars* by Wadia (1957) was noticed in the subsoil. The *Kankars* were also found scattered on the surface of the soil. *Prosopis-Cynodon* community was confined to Akhon Baba stand. The community is protected because of proper fencing. The soil is silt loam, strongly calcareous and is moderately saline. The ratio of available Na, K, Ca, PO4 and NO3 in the stand to that of wild-land is highest (Table 3). The amount of total water-extractable salts recorded here is also highest of the four communities. *Desmostachya-Cenchrus-Cynodon* community was restricted to Pir Sabak stand which lies at the foot of a hillock. The soil is loam in texture and contains a high proportion of sand (Table 2). The *Kankars* of varying sizes have been noticed at a depth of about 30 cm. The amount of organic matter, CaCO3 contents and the water-holding capacity of the soil is lowest. The grazing is frequent.

Cynodon dactylon is either dominant or co-dominant in all the four communities. Only a few arborescent species were recorded in these stands, of which *Prosopis glandulosa* is either a leading or a co-dominant in two communities whereas *Capparis decidua* is co-dominant in one only. In three communities, where and proportion of the soils is lower, one of the dominants of the community is always a grass and the other a woody species. In one community, where sand proportion of the soil is considerably higher, all the three dominants of the community are grasses.

No significant difference in the amounts of Na, K and NO3 available to the plants in the soils of the research sites and adjacent wild-lands was noticed (Table 3). The amount of PO4 was found to be slightly higher in the stands than the wild-lands. The research sites were three times richer in Ca than the surrounding lands.

Discussion

Commuuity Relations :

The community dominants seem to be governed by the texture and the calcareous nature of the soil whereas the number of species in a community is limited by the degree of salinity and the amount of total water-extractable salts in the soil.

Cynodon-Prosopis Community

The community is dominated by *Cynodon dactylon* and *Prosopis glandulosa*. The importance value of *C. dactylon* is higiest in this community (Table 4). The openness of the stand which is manifested by low cumulative canopy-coverage value, high concentrations of available K and N2 in the soil (Table 3), and the calcareous nature of the soil may be held responsible for the dominance of this species (Woodhouse, 1968; Phillips Petroleum Company, 1958; Burton, 1944; Ramakrishnan & Singh, 1966). Because of a high proportion of clay in the soil. the roots of the plants except those of *C. dactylon* and *P. glandulosa* find it difficult to penetrate; and thus these two dominant species have got an edge over the others.

Boerhaavia cocinea Mill.	0.40	0.8	0.12	0.2	N.S.	N.S.	1.0
Saccharum sp.	0.03	N.S.	0.15	0.3	0.01	0.5	0.8
Cymbopogon olivieri (Boiss.) Bor	0.24	0.5	0.01	N.S.	N.S.	N.S.	0.5
Peganum hermala L.	0.09	0.2	0.01	N.S.	N.S.	N.S.	0.2
Medicago laciniata (L.) Mill.	0.02	N.S.	0.01	N.S.	N.S.	N.S.	N.S.
Prosopis farcta (Banks & Sol.(Macbride	0.0	N.S.	0.03	N.S.	N.S.	N.S.	N.S.
Cortharmus lanatus L.	0.02	N.S.	0.03	N.S	N.S..	N.S.	N.S.
Ranunculus sp.	0.02	N.S.	0.01	N.S.	N.S.	N.S.	N.S.

*N.S.—Non-significant.

P. glandulosa which successfully grows under arid conditions (Troup, 1921) is the co-dominant of the community. *P. glandulosa* does not depend entirely on the availability of surface moisture, but can extend its roots at least 20m into the soil to reach and tap the underground lenses of fresh water (Went, 1955; Meinzer, 1927): and thus resists the drought conditions and can survive provided the depth of the underground water is not beyond its reach. This characteristic makes it survive in dry and arid tracts where vegetation of any other kind is scanty (Troup, 1921). The high importance value is largely because of high canopy-coverage contributed by fewer small specimens which are clustered in places. It is reproducing well and the establishment of young seedling is satisfactory.

Kochia indica, a plant of wild-lands; and *Stipa capensis*, a Mediterranean South African grass, are the other important plants.

This commnity supports 30 species of which 6 are grasses.

Cynodon-Capparis Community:

The Cynodon-Capparis community is dominated by *Cynodon dactylon* and *Capparis decidua*. Inspite of being the leading dominant of the community, the importance value of *C. dactylon* is lowest in this than the other communities (Table 5). This community exhibits highest cumulative value of canopy-coverage which is largely contributed by bigger specimens of *C. decidua*. *C. dactylon*, primarily a species of exposed habitats, could not get along in shade which is provided by *C. decidua*. The grazing and particularly the soil that is comparatively deficient in K and NO3 may be held responsible for low importance value of *C. dactylon*.

The importance value of *C. decidua*, the co-dominant of the community, is significant because of a larger contribution made by canopy-coverage (Table 5). Low density coupled with high canopy-coverage indicates the presence of comparatively fewer but healthy growing specimens of this species. Low value of frequency hints at the uneven distribution of *C. decidua*. *C. decidua* was recorded in three of the four communities growing with a wide variety of associates; this hints at its large ecological amplitude (Joshi, 1957; and Qaiser & Qadir, 1972). The presence of *C. decidua* in the communities where soils are strongly calcareous and the proportion of sand in the soil is low, suggests that these two factors possibly control its distribution.

Medicago polymorpha L.	0.14	0.2	0.20	0.5	0.06	1.6	2.3
Sonchus asper (L.) Hill	0.11	0.2	0.18	0.4	0.06	1.6	2.2
Calendula arvensis L.	0.09	0.1	0.07	0.2	0.05	1.4	1.7
Thymelaea passerina (L.) Coss. & Germ.	0.46	0.7	0.18	0.4	0.02	0.5	1.6
Nonnea pulla (L.) DC.	0.17	0.3	0.34	0.8	0.01	0.03	1.4
Calotropis procera (Willd.) R. Br.	0.32	1.0	0.02	*N.S.	0.01	0.03	1.3
Kickxia ramosissima (Wall.) Janchen	0.43	0.6	0.07	0.2	0.01	0.3	1.1
Scabiosa oliveri Coult.	0.08	0.1	0.09	0.2	0.03	0.8	1.1
Cichorium intybus L.	0.17	0.3	0.14	0.3	0.01	0.3	0.9
Tribulus terrestris L.	0.03	N.S.	0.02	N.S.	0.01	0.3	0.3
Psammogeton biternatum Edgew.	0.03	N.S.	0.02	N.S.	0.01	0.3	0.3
Spergula pentandra L.	0.03	N.S.	0.02	N.S.	0.01	0.3	0.3
Rhazya stricta Dcne.	0.43	0.6	0.02	N.S.	0.01	0.3	0.9
Ammi visnaga (L.) Lamk.	0.03	N.S.	0.05	0.1	0.01	0.3	0.4
Solanum miniatum Bernh. ex Willd.	0.03	N.S.	0.02	N.S.	0.01	0.3	0.3
Polygonum plebejum R. Br.	0.06	N.S.	0.07	0.2	0.02	0.5	0.7
Notoceras bicorne (Ait.) Amo.	0.06	N.S.	0.05	0.1	0.02	0.5	0.6
Aerua scandens (Roxb.) Wall. ex Mcq.	0.43	0.6	0.05	0.1	0.01	0.3	0.1
Saccharum sp.	0.17	0.3	0.05	0.1	0.01	0.3	0.7
Imperata sp.	0.03	N.S.	0.09	0.2	0.01	0.3	0.5
Plantago ciliata Desf. var. *lanata* Boiss.	0.03	N.S.	0.02	N.S.	0.01	0.3	0.3

Cymbopogon schoenanthus, a plant of slightly alkaline soils (Hussain, 1964) attains considerable importance value which is chiefly because of its more uniform distribution. *Peganum hermala* is another important plant of this community.

The community supports 42 species, highest of all the four communities, probably because of more niches this community offers to a variety of species to get them established.

Prosopis-Cynodon Community

The Prosopis-Cynodon community is dominated by *Prosopis glandulosa* and *Cynodon dactylon* (Table 6). *P. glandulosa* is in fact an invasive exotic but is natural-

TABLE 7. Phytosociological attributes of *Desmostachya-Cenchrus-Cynodon community*

(CC, canopy-coverage; RCC, relative canopy-coverage; D, density; RD, relative density F, frequency, RF, relative frequency; and IV, importance value).

Species	CC	RCC	D	RD	F	RF	Iv
Desmostachya bipinnata (L.) Stapf.	16.08	24.3	8.13	20.8	0.40	13.4	58.5
Cenchrus ciliaris L.	7.83	11.8	8.33	21.3	0.70	23.4	56.5
Cynodon dactylon (L.) Pers.	7.00	10.6	12.60	32.2	0.40	13.3	56.1
Ziziphus nummularia (Burm. f.) Wight & Arn.	18.25	27.6	2.87	7.3	0.33	11.0	45.9
Rhazya stricta Dcne.	3.83	5.8	0.47	1.2	0.13	4.3	11.3
Peganum hermala L.	2.08	3.1	0.93	2.4	0.17	5.7	11.2
Carthamus lanatus L.	0.66	1.0	1.33	3.4	0.10	3.3	7.7
Aerua scandens (Roxb.) Wall. ex Moq	2.58	3.9	0.20	0.5	0.07	2.3	6.7
Kochia indica Wight.	1.40	2.1	0.47	1.2	0.10	3.3	6.6
Herniaria hirsuta L.	1.00	1.5	0.93	2.4	0.07	2.3	6.2
Chenopodium album L.	0.58	0.9	0.87	2.2	0.07	2.3	5.4
Echinops echinatus Roxb.	1.00	1.5	2.07	0.7	0.07	2.3	4.5
Opuntia dillenii Haw.	2.08	3.1	0.07	0.2	0.03	1.0	4.3
Alloteropsis cimicina (L.) Stapf.	0.50	0.8	0.60	1.5	0.03	1.0	3.3
Asparagus capitatus Baker	0.17	0.3	0.13	0.3	0.07	2.3	2.9
Diarthron vesiculosum (Fisch. & Mey) C.A. Mey.	0.50	0.7	0.20	0.5	0.03	1.0	2.2
Phalaris sp.	0.08	0.1	0.20	0.3	0.03	1.0	1.6
Antirrhinum orontium L.	0.08	0.1	0.07	0.2	0.03	1.0	1.3
Boerhaavia coccinea Mill.	0.08	0.1	0.07	0.2	0.03	1.0	1.3

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This community supports a minimum number of species and the controlling factor seems to be the high accumulation of salts (Table 3). Of the 14 species this community has, 3 are grasses and one is sedge.

Desmostachya-Cenchrus-Cynodon Community:

The community is dominated by *Desmostachya bipinnata*, *Cenchrus ciliaris* and *Cynodon dactylon* (Table 7). The low importance values of these dominant species possess almost the same importance value. *D. pinnata*, a grass of exposed and dry places (Salim & Shahid, 1973), is an indicator of moisture present in the deeper layers of the soil (Hussain, 1964). In spite of a higher rainfall at Nowshera, xeric conditions prevail there which are because of poor retention of moisture by the upper porous layer of the soil. *D. pinnata* overcomes this situation by sending down its roots into the deeper layers of the soil. In this plant the roots are 3 to 8 times the size of the aerial parts (Hussain, 1964). The high importance value of *D. pinnata* is largely contributed by canopy-coverage value.

The dominance of *C. dactylon* is largely because of the openness of the community, but relatively low importance value is largely because of the soil deficient in K and NO3 (Table 3). *C. ciliaris*, the other co-dominant, shows low canopy-coverage but its density is high and it is more evenly distributed.

Ziziphus nummularia is an important species of the community. It is largely represented by small stunted specimens which show the pronounced effect of the wind.

This community supports 20 species of which 5 are grasses.

Soil Nutrients :

An adult human body, on the dry weight basis, contains 3% N2, 1.5% Ca, 1% P, 0.35% K and 0.15 % Na (Bell *et al.*, 1972; Wilkinson, 1969). After complete decay, the nutrients are not available to the plants in the same proportion in which they are tied up in the body because they make complexes in the soil and a larger proportion of these is rendered unavailable to plants.. The amounts of available Na, K and NO3 in the soils of the Mesearch sites and the adjacent wild-lands were almost the same, but PO4 was slightly higher in the stands than the wild-lands. In *Prosopis glandulosa* (mesquite) dominated communities this difference becomes more pronounced. In fact mesquite does not have such a significant effect on the avail ability of P; it is the amount of organic matter in the soil that provides a source of energy to the microorganisms of the soil which in turn increase the availability of P to plants (Hannapel *et al.*, 1964). In Prosopis-Cynodon community, where the organic matter contents of the soil are highest of all, the amount of available PO4 is significantly higher than that of adjacent wild-land. The amount of NO3 was was found to be always higher where mesquite is either a dominant or a co-dominant of the community; and this is strictly in conformity with the findings of Tiedmann & Klemmedson (1973). Na, K and Ca do not follow a consistant pattern of distribution in the soils of the research sites and the wild-lands; relatively high proportions of these nutrients were recorded in the communities where high amounts of available NO3 were encountered. This may be because of the necessity of counter ions to maintain electro-neutrality. The mesquite-inhabited soil may be responsible for the higher amounts of Na, K and Ca available there; but the authors cannot provide a direct and conclusive proof of this hypothesis since it is beyond the scope of this study. Tiedmann & Klemmedson (1973) observed that the mesquite soil did not have any effect on the availability of K, but on the basis of indirect evidence gathered as a result of this study the findings of these workers may be questioned.

TABLE 6. Phytosociological attributes of *Prosopis-Cynodon* Community.

(CC, canopy-cove'age ; RCC, relative canopy-coverage; D, density; RD.relative density ; F, frequency; RF, relative frequency; and IV, importance value).

Species	CC	RCC	D	RD	F	RF	IV
Prosopis glandulosa Torr.	24.30	40.9	13.40	32.4	0.83	3313	106.6
Cynodon dactylon (L.) Pers.	12.80	21.5	22.07	53.4	0.37	14.9	89.8
Tribulus terrestris L.	3.80	6.4	1.27	3.0	0.431	17.3	26.7
Kochia indica Wight	3.80	6.4	1.93	4.6	0.23	9.2	20.2
Prosopis farcta (Banks & Sol.) Macbride	6.08	10.2	0.13	0.3	0.07	2.8	13.3
Boerhaavia coccinea Mill.	1.10	1.8	0.40	1.0	0.13	5.2	8.0
Capparis decidua (Forssk.) Edgew.	3.25	5.5	0.07	0.2	0.03	.12	6.9
Lepidium sp.	0.25	0.4	0.40	1.0	0.10	4.0	5.4
Phalaris sp.	0.58	1.0	0.67	1.6	0.07	2.8	5.4
Fagonia bruguieri DC.	1.00	1.7	0.20	0.5	0.07	2.8	5.0
Scirpus sp.	1.00	1.7	0.47	1.1	0.03	1.2	4.0
Asparagus capitatus Baker	1.25	2.1	0.07	0.2	0.03	1.2	3.5
Chenopodium album L.	0.17	0.3	0.13	0.3	0.07	2.8	3.4
Stipa capensis Thunb.	0.08	0.1	0.07	0.2	0.03	1.2	1.5

ized here. Mesquite constitutes a permanent feature of the vegetation of the plains of Pakistan (Champion *et al.*, 1965). The high importance value of *P. glandulosa* is a most equally snared by all the three sociological attributes. The population of this dominant species largely consists of many young specimens which show quite uniform distribution. The amount of NO3 available in the soil is ten times that of the adjacent wild-land; this further confirms the claim of Tiedmann & Klemmedson (1973) that soils under mesquite provide more favourable environment for the supply of N2. The species is perpetuating well and the rate of establishment of the seedlings is quite high because of a suitable regime of soil moisture and temperature (Scifres & Brock, 1969).

The existance of *C. dactylon*, the co-dominant of community can be justified on the basis of the openness of the community, calcareous nature of the soil, and higher concentrations of K and N2 (Table 2).

Tribulus terrestris and *Kochia india* are other important asscoiates of the community.

TABLE 5. Phytosociological attributes of *Cynodon-Capparis* community.

(CC, canopy-coverage; RCC, relative canopy-coverage; D, density; RD, relative density; F, frequency; RF, relative frequency; and IV, importance value).

Species	CC	RCC	D	RD	F	RF	IV
Cynodon dactylon (L.) Pers.	6.92	10.2	14.53	35.9	0.24	6.5	52.6
Capparis decidua (Forssk.) Edgew.	18.08	26.7	0.55	1.4	0.23	6.2	34.3
Peganum hermala L.	7.64	11.2	2.83	7.0	0.39	10.5	28.7
Cymbopogon olivieri (Boiss.) Bor.	6.78	10.0	2.46	6.0	0.22	5.9	21.9
Stipa capensis Thunb.	1.75	2.5	3.25	8.0	0.36	9.8	20.3
Diarthron vesiculosum (Fisch. & Mey.) C.A. Mey.	2.88	4.3	1.98	4.9	0.26	7.0	16.2
Cousinia minuta Boiss.	2.99	4.4	2.39	5.9	0.20	5.4	15.7
Ziziphus nummularia (Burm. f.) Wight & Arn.	6.06	8.9	0.23	0.6	0.08	2.2	11.7
Fagonia bruguieri DC.	1.52	2.2	1.36	3.4	0.22	5.9	11.5
Cenchrus ciliaris L.	2.24	3.3	1.62	4.5	0.11	2.9	10.7
Phalaris sp.	1.05	1.6	2.14	5.3	0.14	3.8	70.7
Euphorbia falcata L.	0.40	0.5	0.69	1.7	0.16	4.3	6.6
Haloxylon recurvum Bunge ex Boiss.	1.09	1.6	0.49	1.2	0.10	2.7	5.5
Carthamus lanatus L.	1.20	1.9	0.53	1.3	0.08	2.2	5.4
Plantago ovata Forssk.	0.43	0.6	0.55	1.4	0.11	2.9	4.9
Conyza aegyptiaca Ait.	0.25	0.4	0.58	1.4	0.10	2.7	4.5
Scirpus sp.	0.25	0.4	0.85	2.1	0.05	1.4	3.9
Stachys parviflora Bth.	1.35	1.9	0.20	0.5	0.05	1.4	3.8
Herniaria hirsuta L.	0.29	0.4	0.71	1.8	0.06	1.6	3.8
Prosopis farcta (Banks & Sol.) Macbride	0.46	0.7	0.34	0.8	0.07	1.9	3.4
Oxalis corniculata L.	0.26	0.4	0.23	0.6	0.05	1.4	2.4

TABLE 4. Phytosociological attributes of *Cynodon-Prospois* community.

(CC, canopy-coverage; RCC, relative canopy-coverage; D, density; RD, relative density; F, frequency; RF, relative frequency; and IV, importance value).

Species	CC	RCC	D	RD	F	RF	IV
Cynodon dactylon (L.) Pers.	15.0	31.4	24.80	51.2	0.53	25.1	107.7
Prosopis glandulosa Torr.	15.7	32.8	0.77	1.6	0.25	10.9	45.3
Kochia indica Wight.	3.9	8.2	5.20	10.7	0.25	11.8	30.7
Stipa capensis Thunb.	3.2	6.7	7.27	15.0	0.18	8.5	30.2
Cenchrus ciliaris L.	1.9	3.9	4.53	9.4	0.12	5.7	19.0
Chenopodium album L.	1.4	2.9	1.15	2.4	0.19	9.0	14.3
Tribulus terrestris L.	0.51	1.0	0.85	1.8	0.08	3.8	6.6
Capparis decidua (Forssk.) Edgew.	2.14	4.5	0.06	0.1	0.03	1.4	6.0
Lepidium sp.	0.51	1.0	0.42	0.9	0.08	3.8	5.7
Ruellia prostrata Lamk.	0.38	0.8	0.61	1.3	0.06	2.8	4.9
Withania somnifera (L.) Dunal	0.65	1.4	0.07	0.1	0.04	1.9	3.5
Scirpus sp.	0.24	0.5	0.75	1.5	0.03	1.4	3.4
Youngia japonica (L.) DC.	0.19	0.4	0.17	0.4	0.04	1.9	2.7
Amaranthus viridis L.	0.30	0.6	0.18	0.4	0.03	1.4	2.5
Coronopus didymus (L.) Sm.	0.27	0.6	0.35	0.7	0.02	0.9	2.2
Conyza aegyptiaca Ait.	0.16	0.3	0.13	0.3	0.03	1.4	2.0
Eruca sativa Miller.	0.06	0.1	0.10	0.2	0.03	1.4	1.7
Acnyranthes sp.	0.06	0.1	0.06	0.1	0.03	1.4	1.6
Convolvulus arvensis L.	0.13	0.3	0.07	0.1	0.02	0.9	1.3
Phalaris sp.	0.11	0.2	0.23	0.5	0.01	0.5	1.2
Ammi visnaga (L.) Lamk.	0.05	0.1	0.07	0.1	0.02	0.9	1.1
Ziziphus mauritiana Lam.	0.05	0.1	0.04	*N.S.	0.02	0.9	1.3

TABLE 2. Soil characteristics of the stands.

Community	Stand	Soil Class	Sand %	Silt %	Clay %	CaCo3 %	pH	Organic Matter %	Maximum Water-holding Capacity %
Cynodon-Prosopis	Naugaza	Silty clay	14.0	38.4	47.6	18.2	7.5	0.60	44.9
Cynodon-Capparis	Tehkal	Silty clay loam	19.2	44.8	36.0	16.5	7.6	0.73	47.8
Prosopis-Cynodon	Akhoon Baba	Silt loam	24.0	50.5	25.5	17.5	8.0	0.82	46.7
Desmostachya-Cenchrus-Cynndon	Pir Sabak	Loam	49.2	30.8	20.0	7.5	8.1	0.39	38.0

TABLE 3. Chemical Analysis of Soil. (S—Stand; W—Wild-land; SES—Saturated extract of Soil).

Community (Stand)	Available nutrients (ppm)										Speciefic conductance of SES in milli mhos per cm.	Degree of Salinity	Total Water-extractable Salts. (ppm)
	Na		K		Ca		No3		Po4				
	S	W	S	W	S	W	S	W	S	W			
Cynodon-Prosopis (Naugaza)	137	116	636	494	775	325	204	191	87	73	1.60	Non-Saline	1024
Cynodon-Capparis (Tehkal)	104	122	95	151	900	725	126	134	64	59	1.05	Non-Saline	672
Prosopis-Cynodon (Akhoon Baba)	767	219	806	111	3840	1050	2097	192	146	108	5.20	Moderately Saline	3328
Desmostachya-Cenchrus—Cynodon (Pir Sabak)	80	228	143	446	630	430	167	188	135	127	2.60	Very slightly saline	1664

Nowshera consist of great slate series with minor limestone and marble bands (Imperial Gazetteer of India, 1908).

The Peshawar Basin is covered with rich alluvial deposits, the position and depth of which varies in different localities. The soil of Naugaza stand belongs to Peshawar Asoociation and has been derived from piedment alluvia of pleistocene period (Directorate of Soil Survey West Pakistan, 1967). It is fine-textured and moderately structured. The soil of Tehkal stand may be assigned to Tangi Association developed on the dissected loess plain from wind-blown sediments of pleistocene period. The soil of Akhon Baba stand may be referred to Mackeson Association developed from loess plain of pleistocene period. It is medium-textured and shows weak structure. The soil of Pir Sabak stand belongs to Kunda Association and is derived from local fans and piedment aprons of holocene period. This is coarse-textured soil showing very weak structure.

Climate

Peshawar District has a continental type of climate. Temperature extremes have been recorded both in summer and winter. January is the coldest month whereas the hottest month is June (Table 1). A major proportion of the rainfall comes in the months of spring. June is the driest month. Averages of mean maximum and mean minimum temperatures of Peshawar are not much different from that of Nowshera, but the average rainfall of Nowshera (606 mm) is higher than that of Peshawar

Materials and Methods

The vegetation was sampled in 1 x 0.5 m quadrats laid systematically. The canopy-coverage values were recorded according to Daubenmire's method (1959). The number of plants in each quadrat was also recorded. Phytosociological attributes were estimated and communities were constituted on the basis of importance values (Chaghtai & Yusaf, 1976).

The samples of soil from top 35 cm of the research sites were collected and texture was determined according to the method suggested by the American Society for Testing and Materials (1964). The organic matter and $CaCO_3$ contents of the soil were estimated (Jackson, 1962); the water-holding capacity of the soil was determined by the method of Keen (1931) as described by Kramer (1949); and pH was calculated by Fisher Accument Model 230 pH/Ion Meter (Jackson, 1962) (Table 2). An estimate of the available Ca, Na, K, PO_4 and NO_3 in the soils of the stands and those of the adjacent wild-lands was also made (Table 3). Na and K were estimated in ammonium acetate extract by Gallenkamp Flame Analyser (Jackson, 1962); PO_4 was determined in sodium bicarbonate extract (Olsen *et al.*, 1954); and water-soluble form of Ca (Akhtar & Shah, 1978) and NO_3 (Jackson, 1962) were calculated. The degree of salinity and the amount of total water-extractable salts in the soil were estimated by determining the specific conductance of the saturation extract of the soil by Conductivity Meter LBR (Jackson, 1962). The degree of salinity is expressed in the terms used by Jackson (1962).

The nomenclature followed for the plants in this work is that of Stewart (1972).