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PHYTO SOCIOLOGICAL STUDIES IN WASTELANDS OF QUETTA-PISHIN DISTRICTS, BALUCHISTAN, PAKISTAN

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Abstract

Using tabular comparison technique six plant communiteis, viz., *Peganum harmala-Hordeum murinum- Poa annua, Salsola kali- Alhagi maurorum, Kochia stellaris, Salsola kali, Peganum harmala-Hordeum murinum* and *Gaillonia eriantha-Suaeda* sp. were recognized in the wastelands of Quetta-Pishin area. The composition of vegetation was found to vary from community to community. Soil samples obtained from these communities have been analysed for physical and chemical characteristics. The soil of the study area was calcarious with basic reaction. It showed marked variation in texture, amounts of soluble ions, salinity and sodicity levels.

Introduction

Quetta and Pishin districts lie between 29° to 32° latitudes and between 66° to 68° longitudes. In these districts about 62% of total reported area (total area = 1,103,000 acres) is lying waste (Anonymous, 1973), out of which 287,000 acres are culturable wastelands. The information about composition of vegetation and soil conditions of these wastelands is very poor. A sound knowledge of the composition of vegetation and existing soil conditions is therefore a pre-requisite for proper utilization of these wastelands.

In the present work different localities in the study area were visited for vegetation study and soil sampling. On the basis of these studies, different plant communities have been recognized and the soil samples have been analysed for their physical and chemical characteristics. It is expected that data obtained from these studies will provide some basis for planning of future developmental projects for these wastelands.

Materials and Methods

Location: Twenty-five stands (appox. 1000 sq. m size) in wastelands of Quetta-Pishin area were studied in May and June, 1982 (Table 1).

Table 1. Location of Sampled Stands.

Plot No.	Location
1	Village Gangalzai about 25 miles from Pishin Alizai Road.
2	– do –
3	do
4	Village Hajizai, about 26 miles from Pishin on Alizai Road.
5	– do –
6	– do –
7	Village Gangalzai, about 25 miles from Pishin on Pishin Alizai Road.
8	Kuchlak, about one mile away from Kuchlak on Quetta Pishin Road.
9	Kuchlak, (front of the old Mosque).
10	Kuchlak, between the road and mountain base of Kuchlak.
11	Kuchlak, (near Railway Station).
12	Near Kuchlak high School.
13	Near Kuchlak grave yard.
14	Near Kuchlak Station.
15	Fort wall of Kuchlak Mountain.
16	Killi Kathere Bus stop.
17	Kuchlak, the area on the leeward side toward Quetta.
18	West side of the Yarru Railway Station.
19	West North side of the Yarru Railway Station.
20	Near Yarru Railway Station.
21	Near Broadcasting Corporation Station.
22	Bund Khush-Dil Khan (near stream) 10 miles away from Pishin.
23	– do –
24	Bund Khush-Dil Khan (near rest house) 10 miles away from Pishin.
25	On the west of Bund Khush-Dil Khan, 10 miles from Pishin.

Vegetation Study: The vegetation was studied by line Transect method (Canfield, 1941). In each stand 3 sixteen meters long line transects were laid at random. The cover of plant species intercepting the line was recorded and averaged. Vegetation was classified by tabular comparison method. The details of the method were the same as described by MuellerDombois & Ellenberg (1974). Similarity indices between different communities were determined by Jaccard's (1928) and Ellenberg's (1956) formulae. Plants were named following Stewart (1972).

Soil Analysis: Three composite soil samples were obtained from 0-15 cm. depth from each stand. These were analysed for their physical and chemical characteristics. These included the determination of texture by hydrometer method (Bouyoucos, 1951),

water-stable aggregates by wet sieving method (Anonymous, 1954), water holding capacity (Keen & Raczkowski Method as in Piper, 1942); pH (saturated paste) with glass electrode pH meter; electrical conductivity by Beckman conductivity meter; alkaline earth carbonates were determined with acid neutralization method (Anonymous, 1954) and organic matter content by chromic acid heat of dilution method of Walkley & Black (Jackson, 1959). Soluble ions, Ca^{++}, Mg^{++}, $CO3^{--}$, $HCO3^{-}$, and Cl^{-} were determined by titration method (Anonymous, 1954). Na^{+} was determined by flame photometry.

Results

Floristic composition and average cover class: In the study area 25 stands were established and 38 plant species were recorded (Table 2). Only three species, viz., *Salsola kali, Peganum harmala, Hordeum murinum* have high average cover class (0.88–0.96), 10 plant species, viz., *Chrozophora obliqua, Scabioza olivieri, Haloxylon grifithii, Centauria calicetrapa, Eragrostris poaoides, Scrophularia* sp., *Frankenia pulverulenta, Artemisia maritima, Ceratocephalus falcatus* and *Cyperus rotundus* have lowest average cover class (0.04), while remaining 25 plant species have intermediate average cover class values (0.08-0.75, Table 2).

Constancy class: Five plant species, viz., *Alhagi maurorum, Diarthron vesiculosum, Hordeum murinum, Poa annua* and *Salsola kali* have constancy class III (44-56%). Five plant species like *Achellia santolina, Carthamus lanatus, Malcolmia africana, Plantago lanceolata,* and *Veronica biloba* have constancy class II (20-40%) while remaining 28 plant species have constancy class I (0-20%). This means that maximum number of plant species were represented in constancy class I, and minimum number of plant species are present in constancy classes II and III.

Composition of vegetation and soil conditions in different communities: On the basis of Tabular comparison 6 different plant communities were recognized in the study area. Data pertaining to similarity indices between different plant communities (Table 3) show that almost all combinations of communities have low similarity. However, values of similarity indices obtained by Jaccard's formula are relatively higher than those with the Ellenberg's formula. Results of detailed studies of composition of vegetation and soil physical and chemical characteristics in each of these plant communities are described below:

Peganum harmala- Hordeum murinum- Poa annua community

Vegetation. Besides dominant species, *Diarthron vesiculosum, Alhagi maurorum, Malcolmia africana, Centauria calicitrapa* and *Haloxylon grifithii* have greater coverage (72.0%) than remaining 15 plant species (Table 2) but they have low constancy.

Table 2. Composition of vegetation in wastelands of Quetta-Pishin area.

Plant species	Average cover class Total Nos. of stand = 25	Constancy % and constancy class Total Nos. of stand = 25	*Peganum harmala, Hordeum murinum* and *Poa annua* *10, 12, 13, 14, 15, 16, 17, 19	*Salsola Kali* and *Alhagi maurorum maurorum* 1, 2, 3, 7, 8, 18, 20	*Kochia Stellaris* 22, 23, 24, 25	*Salsola Kali* 4, 6, 21	*Peganum harmala* and *Hordeum murinum* 5, 11	*Gaillonia eriantha-suaeda* sp. 9
Salsola Kali L.	0.96	48, III	1.8 ±1.58	20.60±10.05	–	4.44±0.78	–	–
Poa annua L.	0.6	52, III	2.62±0.80	3.02± 1.49	–	0.80±0.0	–	–
Malcolmia africana L.	0.28	28, III	2.05±0.0	1.36± 0.65	–	2.22±0.78	–	0.95±0.0
Torularia torulosa (Dsf) O.E.S.	0.2	20, I	–	0.44± 0.0	1.5 ±0.50	–	–	–
Plantage lanceolata L.	0.32	32. II	0.11±0.0	2.51± 1.72	1.07±0.17	–	–	–
Cotula aurea Loeffl.	0.08	8, I	–	0.33± 0.17	–	–	–	–
Alhagi maurorum Medic	0.56	48, III	2.56±1.66	2.07± 0.90	–	–	0.27± 0.0	–
Polygonum afghanicum Meissn	0.12	12, I	0.51±0.40	0.11± 0.0	–	–	–	–
Euclidium syriacum (L.) R. Br.	0.2	20, I	0.38±0.0	3.47± 1.86	–	0.33±0.0	–	–
Veronica biloba L.	0.24	24, II	0.18±0.04	2.41± 0.52	–	1.44±0.0	–	
Achillea santolina L.	0.4	40, II	1.24±0.41	0.48± 0.13	–	0.66±0.0	–	–
Lepidium sp.	0.08	8, I	–	0.38± 0.0	–	2.61±0.0	–	–
Garhadiolus minutissimus (Burye) Kitamura.	0.12	12, I	1.22±0.0	0.35± 0.02	–	–	–	–
Agropyron squarosum L.	0.08	8, I	–	0.85± 0.41	–	–	–	–
Gaillonia eriantha Jaub & Spach	0.12	4,	–	–	–	–	–	15.16±0.0
Cousinia minuta Boiss.	0.12	12, I	–	0.99± 0.88	–	–	–	–
Cyperus rotundus L.	0.04	4, I	–	–	–	5.44±0.0	–	–
Cynoden dactylon (L.) Pers.	0.12	12, I	–	0.38± 0.0	–	2.22±0.0	3.33± 0.0	–

Adonis aestivalis L.	0.8	8, I	–	–	–	0.36±0.24	–	–
Peganum harmala L.	0.96	44, III	10.96±2.60	–	–	7.91±7.54	32.13±23.98	–
Hordeum murinum L.	0.88	56, III	7.13±1.74	2.02± 0.19	–	1.72±0.0	7.05± 04	0.72±0.0
Heteroearyam rigidum DC	0.08	8, I	–	–	–	0.22±0.0	0.66±0.0	–
Heliotropium dasyearpum Ledeb.	16, I	0.38±0.0	1.38±0.0	–	–	–	0.11± 0.0	–
Carthamus Lanatus L.	0.32	28, II	1.40±0.83	3.24± 3.14	–	–	2.11± 0.0	–
Atriplex dimorphostegia Ker 8c	0.8	8, I	–	2.05± 0.0	–	–	–	0.11±0.0
Ceratocephalus falcatus (L.) Pers	0.4	4, I	0.88±0.0	–	–	–	–	–
Artemisia maritima L.	0.04	4, I	–	0.66± 0.0	–	–	–	–
Euphorbia granulata Forssk.	0.16	16, I	0.19±0.13	0.94± 0.66	–	–	–	–
Diarthron vesiculosum (Fiseh 8c Meys C.A. Mey	0.48	44, III	2.44±1.01	0.22± 0.0	0.91±	–	0.16	–
Frankenia pulverulenta L.	0.04	4, I	–	–	–	0.27±0.0	–	–
Scrophularia sp.	0.04	4, I	–	–	–	–	–	0.55±0.0
Suaeda sp.	0.12	4, I	–	–	–	–	–	12.72±0.0
Eragrostis Poa oides p. Beauu.	0.04	4, I	1.33±0.0	–	–	–	–	–
Centauria calicitrapa L.	0.04	4, I	2.16±2.05	–	–	–	–	–
Haloxylon griffithii (Moq.) Bunge	0.04	4, I	2.16±0.0	–	–	–	–	–
Scabiosa olivieri Coult.	0.04	4, I	0.38±0.0	–	–	–	–	–
Chrozophora oblique (vahl) Juss Express	0.04	4, I	–	0.22± 0.0	–	–	–	–
Kochia stellaris Moq.	0.36	16, I	–	–	18.91±2.49	–	–	–

* Stand number.

Table 3. Similarity indices between different plant communities.

Communities	ISE	ISJ
A & B	27.00	50.00
A & C	3.41	9.09
A & D	22.00	30.76
A & E	27.73	27.27
A & F	7.03	8.33
B & C	4.32	11.53
B & D	25.00	30.00
B & E	10.49	22.22
B & F	4.24	10.71
C & D	0.00	0.00
C & E	0.75	0.09
C & F	0.00	0.00
D & E	24.79	22.22
D & F	4.68	11.11
E & F	5.12	7.70

A = *Peganum harmala – Hordeum murinum – Poa annua* community.
B = *Salsola Kali – Alhagi maurorum* community.
C = *Kochia stellaris* community.
D = *Salsola kali* community.
E = *Peganum harmala – Hordeum murinum* community.
F = *Gaillonia eriantha – Suaeda* sp. community.

Soil: Soils of *P. harmala, H. murinum* and *P. annua* community are poorly to well aggregated sandy loam to loamy sand. They are basic in reaction and moderately calcarious. They have medium water holding capacity and low to medium organic matter content. They are salt-free and sodium free to slightly salt-affected and slightly sodic with low to medium amounts of soluble cations and anions (Table 4).

Salsola kali- Alhagi maurorum Community

Vegetation: A total of 25 plant species were recorded from this community. Besides dominant species, 6 plant species, viz., *Hordeum murinum, Poa annua, Carthamus lanatus, Eucalidium syriacum, Veronica biloba, Plantago lanceolata* and *Atriplex dimorphostegia* have relatively greater cover (Table 2).

Soils: Soils of *S. kali* and *A. maurorum* community are poorly to moderately aggregated, (mostly coarse-textured) silt loam to loamy sand. They are moderately

calcarious and basic in reaction. They have medium water holding capacity, low to medium organic matter content and they have low to medium amounts of soluble ions. They are salt-free to moderately saline and sodium free to moderately sodic (Table 4).

Kochia stellaris community

Vegetation: Four plant species were recorded from this community. Only one plant species, i.e. *Tourlaria torulosa* has appreciably high cover (Table 2).

Soils: Soils of *K. stellaris* community are moderately calcarious, silt loam and loam with poor to good aggregation. They have medium water holding capacity and are basic in reaction. They have low to medium amount of organic matter and high amount of soluble ions. These soils are slightly saline to strongly saline and sodium-free to strongly sodic (Table 4).

Salsola kali community

Vegetation: Peganum harmala, Malcolmia africana, Cynodon dactylon and *Cyperus rotundus* have relatively greater cover in this community (Table 2).

Soils: Soils of *S. kali* community are poorly aggregated silt loam with basic reaction. They are moderately calcarious. They have medium water holding capacity, low to medium organic matter and low to high amount of soluble ions. They are salt-free to strongly saline and sodium-free to slightly sodic (Table 4).

Peganum harmala and *Hordeum murinum* community

Vegetation: In *P. harmala* and *H. murinum* community, *Carthamus lanatus* and *Cynodon dactylon* have greater cover than other species.

Soils: Soils of *P. harmala* and *H. murinum* community are poorly aggregated silt loam and sandy loam with basic reaction. They have medium water holding capacity and low to medium soluble ions. They are strongly calcarious and are salt-free and sodium-free (Table 4).

Gaillonia eriantha- Suaeda sp. community

Vegetation: Only 6 plant species were recorded from this community. None of the species have appreciable cover (Table 2).

Table 4. Soil conditions in the sampled stands of various community types of wastelands of Quetta-Pishin areas.

Soil conditions	Plant communities*					
	1	2	3	4	5	6
	+ 10, 12, 13, 14, 15, 16, 17, 19	1, 2, 3, 7, 8, 18, 20	22, 23, 24, 25	4, 6, 21	5, 11	9
Physical						
Texture						
Sand, %	x 70.75± 1.39 xx 55.46–80.34	53.02± 3.15 17.94–80.80	31.86± 1.20 21.60–50.26	36.55± 2.66 21.54–48.06	62.50± 0.0 53.40–71.60	57.53± 4.81
Silt, %	19.35± 1.67 7.26–36.74	37.94± 2.91 6.20–69.20	58.48± 1.20 44.14–64.60	51.06± 2.05 42.34–60.26	29.43± 1.33 19.80–39.06	37.93± 5.33
Clay, %	9.90± 0.29 5.00–13.86	9.04± 0.38 6.00–13.00	9.65± 0.0 5.60–13.80	12.38± 1.16 9.34–18.20	8.04± 1.33 7.54– 8.54	4.54± 1.33
Textural class	Loamy sand to sandy loam	Loam sand to silt	Loam to silt loam	Silt loam	Sandy loam, silt loam	Sandy loam
Water holding capacity, % soil O.d. wt.	37.38± 1.08 34.88–40.16	37.20± 1.55 31.98–41.30	42.00± 1.29 39.30–45.84	38.74± 1.12 34.08–44.17	35.0 ± 0.45 33.38–36.62	36.29± 1.50
Water-stable aggregates, % soil a.d. wt.	6.34± 0.79 0.38–18.06	3.18± 0.64 0.65– 8.93	8.13± 0.8 2.80–15.6	1.92± 0.43 0.12– 4.6	1.58± 0.79 1.1 – 2.06	2.76± 1.02
Chemical						
pH	8.01± 0.07 7.90– 8.2	8.04± 0.04 7.86– 8.13	8.02± 0.05 7.85– 8.35	8.21± 0.08 7.93– 8.46	7.93± 0.13 7.9 – 7.96	7.76± 0.03

Electrical conductivity, m mhos/cm	1.94± 0.07 0.63–10.00	4.49± 0.64 1.00–11.66	26.69± 2.42 5.1 –52.66	6.17± 1.95 0.86–15.66	0.86± 0.05 0.56– 1.16	2.9 ± 0.15
Organic matter, % soil O.d. wt.	1.14± 0.10 0.52– 1.86	0.65± 0.03 0.07– 1.12	0.87± 0.11 0.6 – 1.14	0.85± 0.09 0.51– 1.18	0.77± 0.10 0.62– 0.92	0.78± 0.08
Ca CO_3% eq.	12.28± 0.49 11.06–13.62	12.61± 0.70 11.21–15.23	10.32± 0.24 9.85–11.21	11.00± 0.55 9.43–13.10	13.10± 0.38 10.91–15.30	15.07± 0.07
Soluble anions meq/l						
Cl^-	24.66± 0.60 6.4 –120.5	30.75± 2.22 10.4 –72.2	596 ±14.12 104 –850	56.13± 5.71 8.4 –140.00	8.1 ± 0.17 7.2 – 9.00	12.6 ± 1.58
HCO_3^-	11.75± 0.25 10.00–12.00	15.14± 3.21 8.00–36.00	10.5 ± 0.35 10.0 –12.0	12.66± 0.66 8.0 –18.0	15.25± 3.1 10.5 –20.0	10.0 ± 2.0
CO_3^{--}	–	–	–	–	–	–
Soluble cations meq/l						
$Ca^{++}+ Mg^{++}$	17.95± 2.91 8.8 –68.6	32.58± 5.32 10.8 –53.06	132.85±11.02 60.2 –203	29.28± 3.02 6.6 –67.2	9.5 ± 0.36 8.4 –10.6	27.00± 6.68
Na^+	16.03± 1.74 1.00–108.00	39.18± 5.18 4.7 –145.00	322.6 ±35.88 32.8 –784.6	33.17± 1.43 3.3 –87.73	2.4 ± 0.62 1.1 – 3.7	14.6 ± 2.36
Sodium absorption ratio	3.44± 0.56 0.47–19.12	8.88± 0.80 1.11–27.96	46.38± 8.92 4.35–134.01	6.76± 0.26 1.86–15.23	1.07± 0.28 0.53– 1.61	3.99± 0.15
Exchangeable sodium percentage	5.40± 0.60 1.92–22.63	11.61± 0.82 2.82–29.77	43.21± 4.01 7.07–68.34	9.56± 0.28 3.85–19.20	2.76± 0.39 2.0 – 3.52	6.67± 0.19

\+ Stand number x Mean with standard error xx Range * Community Nos. 1-6. See legend in Table 2.

Soils: The soils of *G. eriantha* and *Suaeda* sp. community are poorly aggregated sandy loam with basic reaction and they are strongly calcarious. They have medium water holding capacity, low organic matter and soluble ions. They are salt-free and sodium-free (Table 4).

Discussion

In the study area 6 different plant communities, viz., *Peganum harmala-Hordeum murinum- Poa annua, Salsola kali- Alhagi maurorum, Kochia stellaris, Salsola kali, Peganum harmala- Hordeum murinum* and *Gaillonia eriantha- Suaeda* sp. were recognized. The values of similarity indices were generally low (Table 3), which clearly indicated that the composition of vegetation of six plant communities recognized in the present work differed significantly from one another. In all these communities total plant cover and total number of plant species was low (Table 2). Aridity is the characteristic feature of the study area (Ahmed, 1951; Ali, 1971). In arid regions vegetative cover is low and sparse (Emberger & Lamee, 1962). Under arid conditions the density of vegetation decreases with decreasing precipitation giving diffuse type of vegetation (Mond, 1954) which is characterized by shallow root system with considerable horizontal growth (Walter, 1961).

Soil of 6 plant communities showed significant variations in texture, amounts of soluble cations and anions and salinity and sodicity status (Table 4). Soils of 3 communities (*Salsola kali-Alhagi maurorum, Kochia stellaris* and *Salsola kali*) have average values of electrical conductivity, soluble cations and anions and exchangeable sodium percentage was greater than 4.0 m mhos/cm, 30.0 meq/l and 10.0, respectively (Table 4). These communities indicate saline and or/sodic soil conditions. Soils of other 3 communities, viz., *Peganum harmala-Hordeum murinum- Poa annua, Peganum harmala-Hordeum murinum* and *Gaillonia eriantha- Suaeda* sp. have average values of electrical conductivity, soluble cations and anions and exchangeable sodium percentage lesser than 4.0 m mhos/cm, 30 meq/l and 10.0, respectively (Table 4). These communities indicate salt and sodium-free conditions. Dominant plants (except *Suaeda* sp.) of these communities are glycophytes. Genus *Suaeda* is generally considered halophyte. Its presence and dominance (only in one plot) in salt- and sodium-free soils might be a chance factor. Though soils of *Gaillonia eriantha* and *Suaeda* sp. community are non saline non alkaline but they have appreciable high values of electrical conductivity (2.9 mhos/cm) and exchangeable sodium percentage (6.7).

Presence of appreciable amount of alkaline earth carbonates ($CaCO_3$) and relatively low amounts of clay and organic matter (Table 3) is a characteristic feature of arid zone soils (Aubert, 1960). Relatively low values of water holding capacity and water-stable aggregates (Table 4) might be due to low amounts of clay and organic matter.

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