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Full Length Research Paper

The phytosociological analysis of saline area of Tehsil Ferozewala, District Sheikhupura (Punjab), Pakistan

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This study is a broad ecological survey, and classification of the vegetation of Agro Farm plantations of a Tehsil Ferozewala (District Sheikhupura) Punjab, Pakistan. The vegetation survey description and classification was according to Zurich-Montpellier School of thought is based on over 300 Relevé Method. In all twelve associations i.e. *Suaedetum fruticosae*, *Kochietum indicum Diplachnetum fuscae*, *Desmostochyetum bipinnatae*, *maurorae*, *Polypogaetum monspeliensae*, Erythraeo-Polypogaetum *monspeliensae*, *Veteviarietum cylindrieae*, *Scirpetum maritimae* and Typhetum angustitae are recognized and each association is further sub-divided into sub-associations and classified into its respective class, order and alliances according to central European Phyto-sociological methods. Several relationships of the plant community types have been worked out during this study. The soil characteristics of each vegetation type are discussed in relation to soil texture; pH, Conductivity, Carbonates, Bicarbonates, Chlorides and Sulphate as well as ecological affinities of each association are also described. By reintegrating these trees and shrubs back into agriculture landscape to reverse salinity such as *Atriplex amnicla*, *Tamarix aphylla*, *Phoenix dactilifera*, *Prosopis* spp. *Susbenia bispinasa*, *Sesbenia sesbena*, *Casorina, Grewia asiatie, Psidium guava* etc. The incorporation of these plants (grasses, shrubs and trees) into agriculture land system of the Punjab has potential to increase crop, fiber, wood and animal production and degradation of land will also be halted.

Key words: Phyto-sociological, agroforestry, relev'es, plant associations, characteristic species, differential species, companion species.

INTRODUCTION

Pakistan is a unique combination of deserts, alluvial plains, low and high hills, valleys and a long coast line. The diversity in climate and soil is well reflected in the ecological distribution of fauna and flora. The climate is generally arid subtropical. The average rainfall is 250 mm, while some of the driest regions receive less than 123 mm annually (Hussain et al., 2003). There is wide range of rainfall starting from 100 mm in the south ton1000 mm in the north. Pakistan has the largest contiguous canal irrigation system in the world; but if not for it, the country would have been a vast unproductive desert (Shinwari et al., 2003).

Trees were cut mercilessly, and subsequently, the nexus between the contractor and the forester played havoc with the country's tree cover, rendering the state of affairs into an almost irreversible situation after 1947(GOP, 2006 – 2007). The relationship of vegetation (under growth of farm trees) and soil characteristics is so inter-dependent that they become indicative of each other. A habitat under certain existing environment would permit plants adapted to the site condition thus the soil-plant-relationship becomes so intimate that plants reflect the ecological conditions of the inhabited area (Anon 1991 and Boggs, 2000). This study is firstly to monitor the effects of progressive pollution of the environment; secondly as a sequential study on the effects of man upon environment in term of recreation and agroforestry within areas of great aesthetic landscape beauty; thirdly

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to provide a scientific phytosociological, photography and ecological basis for conservation or reclamation; and fourthly to produce syntaxanomy of the world vegetation. In this study some aspects will be taken into consideration more related to salt affected soil and their relation to and ultimately to study the impact of salinity on the agroforestry (Rahim et al., 2010).

Most of the marginal lands in Punjab have resulted from various degrees of water-logging and salinity. In the semiarid climate the rainfall is irregular and insufficient to remove soluble salts from the soil; within the soil salts are drawn upward by capillary action and accumulate within the soil profile at the surface, when water evaporates. These soils are either saline and saline sodic or sodic; and this salinity and water-logging which have become more pronounced after 1950 is due to ill-skilled methods of irrigation (Sheikh, 2000: Craig and Wilkinson, 2004). In the absence of proper drainage, the excessive recharge resulted in the rise in the ground water table; on the average it rose by about one foot per year during the period 1900 to 1960 (Sheikh et al., 2000a). Depth to water table in the 45% of the area was 0-5 ft. and in 29% of the area. The adverse process of saltalinization and alkalization, have dexterous effects not only on soil but also on water and on the general environment; they can make it unfit for human habitation and even vegetation. Changes in vegetational composition also occur with change in salinity. Generally there is a sharp decrease in species diversity with even a low increment of soil salinity and that further drops in diversity until only one or two species are left which are capable to tolerating the salinity extremes (Sheikh, 1992a). Climate plays an important role in the formations of salt affected soils; geomorphologic, hydrological, biological, topographical and hydro-geographical conditions also exert great influence on their formation and according to Bargali et al. (1998) the plant cover also contributes to the migration and accumulation of salts in soils. The importance this phenomenon has been realized all over the world. Studies on saltalinization and alkalization of soil, studies on vegetation in relation to soil and agroforestry, have been carried out by various scientists in different countries of the world. As such considerable literature in this regard is available and we may not dilate on that. Moreover the type of research work which we have undertaken is hardly available in local scientific literature. Simply description of vegetation along with soil characteristics have been carried out by many authors (Rutter and Sheikh, 1962; Shah et al., 1961; Iftikhar, 1969; Chapman, 1976; Choudary and Sheikh, 1996; De Velice et al., 1999; Mirza and Bashir, 1996; Ahmad, 1998; Bunce et al., 1999; Tansley, 1999; Boggs, 2000; Kumar et al., 2004; Mishra et al., 2002; Baig et al., 2008; Chaudhry, 1953) has described the vegetation of “Bara” Lands of Punjab and that of water logged areas of Sheikhupura District. Chaudhry (1953) gave a quantitative account of the vegetation of Thal desert and discussed the dynamic relation of communities. Qadir et al., (1966) carried out a phytosociological survey at Karachi campus, recognizing six distinct plant communities and correlated the diversity of the vegetation with edaphic conditions.

MATERIALS AND METHODS

Field study

The past decade has witnessed a proliferation of ecological (Clements, 1904; Tensely, 1920; Vierec et al., 1992), mathematical, statistical approaches (Curtis and Mc–Intosh, 1951; Whittaker, 1980; Unger, 1972; Kershew, 1973; Mueller and Heinz, 1974) to the organization of phytosociological data and subsequent classifications or ordination of data. For the choice of method for describing and cataloguing the data pertinent to a particular problem the best method may be taken to that one which enables the maximum comprehension of structural complexity of vegetation relative to the background environmental variables, in turn relative to the amount of time input. Taking the fact into consideration the vegetation data were analyzed by tabular comparison using the method of successive approximation (Poor, 1955; Shimwell, 1971; Vitt, 1995). The data was collected by recording the cover-abundance values of the 10 points Domin scale (Table 3) of all plants within homogeneous plots positioned within representative stands of the major vegetations types seen. In sampling, it was found that for most situations Relevé areas 2x2 m was suitable; however Relev’es of smaller areas wherever appropriate were also taken. The minimal area determination follows Shimwell (1971). Following procedure was adopted in the subsequent tabulation of the vegetation data.

1) Aggregation of field data into tabular from an erection of differential tables in the process described by Shimwell (1971) and Mueller and Heinz (1974).
2) Use of differential species and differential species groups to characterize units.
3) Erection, differential and characterization of association, Sub associations, variants and noda on basis of over-all floristic similarly; character species of high constancy fidelity and dominance.

a) Name of associations, sub-associations and variant according to code of phytosociological nomenclature (Barkman 1976).
b) Classification of association into higher units using the Zurich-Montpelier school of hierarchical classification
c) Checking and correlating the ecological reality of the units extracted in the field to major environmental gradients
d) Investigation of similar pattern in other localities, thereby obtaining an overall pattern of variation within particular vegetation types.

This method will provide an overall syntax anomy of the farm plantations. The construction of differential table is the basis of this method. Differential table showed the differential species and differential species groups stored into blocks and separated from other species which were listed from high to low constancy, other species were companions and showed a low degree of association with the differential species.

Data compilation, processing and Statistical Analysis DATA analysis followed several specific steps:

i) Coding, in which verbal responses; written answers or accumulated record are converted to numbers;

ii) Data entry, in which coded data are entered directly into computer files;
iii) Descriptive analysis, in which the researcher examines frequency distributions for individual variables;
iv) Cross-tabulation, in which relationships between variables are examined; and
v) Index construction, scaling, and multivariate analysis, in which more complex relationship among variables are dealt with.
vi) The data was processed in Excel programme and was sorted out to get correct picture about: the species preference; pattern/ design of the plantations; age groups of the plantations; age at which the trees were harvested; method of sale; income generated; agriculture crop depression due the trees; land tenure system in vogue.

A survey was undertaken during November 2007 to June 2008 and over 300 Relevé be collected. First, the Relevé was collected together in a raw table. Squared paper was used for this purpose. Each Relevé number and species number were also recorded. This table was called as raw table. The second stage involves underlining the species of intermediate constancy and from these determining the differential species and differential species groups to form another Table. Third stage follows the ordination of the partial table where outline or boxed species were extracted and rearranged in the tables in vertical and horizontal manner. Thus the sequence of Relevé will change. This partial extracted table will highlight this existence of mutually exclusive groups of species (differential species). Finally, completion of differential table, that is, compiling the rest of the species with differential species and differential species groups. The Relive's in a descending order of number of occurrence and Relive's were re-arranged vertically. Thus in a finished Table 2, additional information are Relevé code number of species and constancy class were also added, by this by this method two associations were delimited, but it further data have given a different pattern, then these might be four sub associations under a higher association or variants a sub association. Associations, sub associations and variants thus delimited can be defined as a group of Relive's from stands of homogeneous vegetation characterized by a differential species or a group of differential species with constancy calls V 2.1, 14.5 and IV. The sub association differs by the presence of plants that form certain floristic and ecological sub units within an association, but such units occur in other associations also, variants are characterize by one or two species having dominance within its sub-association.

RESULTS

The relive collected from the study area were arranged in the form of association table and 14 associations were recognized. The description of each association and the physical and chemical characterizes of associated soils and water of each of the community type is being given in association table. K stands for constancy class. Each community is described in the following text, using the procedure as adopted by (Shimwell, 1971; Allen, 1974; Mirza, 1978: Qayyum, 1982). Following is the summary of plant communities described.

Association 1: *Suaedetum fruticosae*

22 stands of different areas *Suaeda fruticosa* is dominant with constancy class V and *Kochia indica* is differential species with constancy class V. *Alhagi maurorum, Acacia arabica, Conyza amibgua, Cynodon dactylon, Dicanthium annulatum, Diplachne fusca* and *Typha angustata* with low constancy class and are companion species. Their floristic composition is given in Table 1. Soils of this community type are sandy loam in nature. The details of the soil characteristic are given in Table 2.

Association 2: *Kochietum indicum*

20 stands of different areas show the floristic composition of this association. The stands show that *K. indica* is dominant with constancy class V *S. fruticosa* and *Desmostachy bipinnatae* are differential species with constancy class V and IV respectively. *C. dactylon, A. maurorum, Sporobolus arabicus, Spregula rubra, Rumex dentatus* and *Peganum harmala* have low constancy class and are companion species. The association is represented by two sub association, sub association typicum where Kochia was dominant and other species were sparsely distributed, while sub association *Kochictosum indicum* and sub *Desmostachyetosum bipinnatae* show *D. bipinnatae* constant along with *K. indica*, while other species were very rare. Their floristic composition is given in Table 1. Soils of this community type are sandy loam in nature. The details of the soil characteristic are given in Table 2.

Association 3: *Diplachnetum fuscae*

The association *Diplachnetum fuscae* is characterized by dominance and constancy class V. Salinity indicating species *S. fruticosa* and *A. maurorum* are frequent; two sub associations recognized are sub associations *D. fuscae;* sub association *Alhagietosum maurorae, Imporata cylindrica*; *A. arabica*; *Sonchus asper; Polygola abyssinica; D. annulatum* are companion species with low constancy class. Stands of associations were collected from Chak No. 45 Ferozewala, Al-Sheikh Trust Hospital; Kala Shah Kaku and opposite Darghi Park. This is also called as Kallar grass and well distributed in most of the salt affected areas. *D. fusca* is suitable species for cultivation with salt affected soil. Their floristic composition is given in Table 1. Soils of this community type are sandy loam in nature. The details of the soil characteristic are given in Table 2.

Association 4: *Desmostochyetum bipinnatae*

24 stands of different areas show floristic composition of Relev'es. *D. bipinnatae* is one of the most salt tolerant halophytes species. It is very frequent on xeric and dusty soil. Their floristic composition is given in Table 1. Soils of

Table 1. Integrated associations.

No	A- Characteristic species											
	Associations	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**	**XI**	**XII**
1	*Suaeda fruticosa*	5-9* (22)V											
2	*Kochia indica*		6-8 (22)**V										
3	*Diplachnae fusca*			7-9 (25)V***									
4	*Desmostachya bipinnata*				6-10 (24)V								
5	*Alhagi maurorum*					6-9 (15)V							
6	*Sprobp;is arabocus*						5-8 (14)V						
7	*Polypogon monspeliensis*							5-8 (23)V					
8	*Polypogon monspeliensis*								3-6 (12)V				
9	*Veteveria zyzanioides*									6-8 (11)V			
10	*Imperata cylindrical*										5-8 (16)V		
11	*Scirpus maritiumus*											6-8 (21)V	
12	*Typha angustata*												5-9 (15)V
	* Cover range (Domin scale) 5-9		** Total No of Relev'e (22)			*** Constancy class I to V							
	B- Differential species												
1	*Kochia indica*	2-3* (22)IV											
2	*Acacia arabica*	2-5 (22)III											
3	*Suaeda fruticosa*		1-4 (22)**V										
4	*Desmostachy bipinnata*		1-5 (22)IV										
5	*Suaeda fruticosa*			1-3 (25)I***									
6	*Alhagi maurorum*			2-4 (25)II									
7	*Kochia indica*				1-3 (24)III								
8	*Dicanthium annulatum*				2-4 (24)II								
9	*Suaeda fruticosa*					1-3 (15)IV							
10	*Kochia indica*					1-3 (15)III							
11	*Kochia indica*						1-3 (14)V						
12	*Desmostachya bipnnata*						1-3 (14)II						
13	*Kochia indica*							5-8 (23)IV					
14	*Suaeda fruticosa*							5-8 (23)IV					
15	*Scirpus martimus*								3-6 (12)V				
16	*Cynodon dactylon*								3-5 (12)III				
17	*Polypogon monspeliensis*									6-8 (11)V			
18	*Erythrae ramosissma*									2-4 (11)V			
19	*Kochia indica*										2-3 (16)V		
20	*Dicanthium annulatum*										3-5 (16)III		

Table 1. Contd.

21	*Kochia indica*						0-5 (21)I	
22	*Rumex dentatus*						3-5 (21)II	
23	*Suaeda fruticosa*							0-2 (15)III
24	*Polypogon monspeliensis*							0-5 (15)III

* Cover range (Domin scale), ** Total No of Relev'e, *** Constancy class

C- companion species

Alhagi maurorum	+-5* (22**)I***							
Conyza ambigua	+-5 (2)II							
Cynodon dactylon	0-3(22)I							
Dicanthium annulatum	0-3(22)I							
Diplachnae fusca	+-3(22)I							
Typha angustata	+-3(22)I							
Cynodon dactylon		+-4 (22)II						
Alhagi maurorum		+-3 (22)II						
Rumexdentatus		+-3 (22)II						
Peganum sp		+-3 (22) I						
Imperata cylindrical			0-5(25)I					
Acacia arabica			0-+(25)I					
Sonchus asper			0-4(25)I					
Polygola abyssinica			0-4(25)I					
Dicanthium annulatum			0-3(25)I					
Alhagi maurorum				0-3(24)II				
Phalaris minor				0-3(24)II				
Calatropis procera				0-3(24)II				
Cynodon dactylon				0-3(24)I				
Conyza ambigua				0-3(24)I				
Paspahum distichum					0-+(15)I			
Acacia arabica					0-+(15)I			
Polypogon monspeliensis					0-+(15)I			
Melitotus indica					0-3(15)I			
Scirpus maritiumus					0-+(15)I			
Conyza ambigua					0-+(15)I			
Polygola abyssinica					0-+(15)I			
Dicanthium annulatum						+-2 (14)IV		
Cynodon dactylon						+-2 (14)II		
Medicago denticulate						+-3 (14)II		
Saccharum spontaneum						+ (14)II		

Table 1. Contd.

Rumex dentatus	+-2(14)I						
Phalaris minor		+-6(23)III					
Erythrae ramorissima		+-5(23)II					
Alhagi maurorum		+-5(23)III					
Polygonum plebjum		3-4(23)III					
Cynodon dactylon		3-5(23)IV					
Scirpus maritmus		0-5(23)II					
Dicanthium annulatum		0-5(23)I					
Chenopodium murale		0-4(23)I					
Dicanthium annulatum			0-5 (12)I				
Sporobolus phallidus			0-4 (12)I				
Imperata cylindrical			0-5 (12)I				
Rumex dentatus			0-5 (12)I				
Dicanthium annulatum				+-5 (11)V			
Rumex dentatus				+-4 (11)V			
Conyza ambigua				+-3 (11)IV			
Euphorbia prostrata				+-3 (11)III			
Launia sp-					0-5(16)I		
Polypogon monspeliensis					0-5 (16)I		
Erythrae ramesisima					0-4(16)I		
Cynodon dactylon					0-4 (16)I		
Sonodon oleraceus					+ (16)I		
Rumex dentatus					0-5 (16)I		
Conyza ambigua					4-5 (16)I		
Paspahum distichum						0-3 (21)IV	
Polypogon monspeliensis						0-4(21)IV	
Sochus asper						+-3(21)I	
Phyla nodiflora						+-3(21)I	
Cynodon dactylon						+(21)I	
Saccharum spontaneum						+(21)I	
Erytraea ramosissma						+-5 (21)II	
Paspahum distichum							+(15)I
Sonchus asper							+(15)I
Sonchus oleraceus							+(15)I
Scirpus martimus							+-3(15)I

Table 2. Soil characteristic of each association.

No	Associations / Characteristic		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
	Soil text class		Silty loam	Silt/Sandy loam	Silty loam	Clay/Sandy/ Silty loam	Clay/Sandy/ Silty loam	Silty loam	Clay/Sandy /Silty loam	Silty clay loam	Silty clay loam	Silt/Sandy/ Clay loam	Silty loam	Clay/Sandy loam
1	pH	*±	8.37±0.35	7.96±0.25	8.08±0.17	8.61±0.32	8.3±0.1	-8.0	7.9±0.2	8.3±0.2	8.1±0.09	8.4±0.2	8.3±0.2	-7.9
2	EC	*±	14.06±5.24	1.90±5.15	10.51±7.96	9.38±4.5	3.5±1.5	-2.05	2.2±0.8	3.9±2.2	4.2±2.1	2.5±0.9	3.6±1.0	-2.8
3	+1NA	*±	71.96±2.9	13.16±1.12	26.04±9.79	57.28±23.36	32.8±24.1	-15.36	11.3±1.4	47.3±34.9	48.9±34.0	23.8±8.4	26.8±10.1	-20.2
4	+1K	*±	1.45±1.45	0.44±1.67	1.46±0.44	1.10±0.32	1.30±0.30	-1.25	0.7±0.2	0.5±0.19	0.8±0.02	1.0±0.2	1.1±0.2	-0.5
5	+2+2 CA+MG	*±	6.79±0.40	6.60±0.93	7.96±3.36	6.70±1.27	7.5±3.0	-4.0	19.7±10.5	11.7±3.7	10.4±2.1	6.2±2.1	15.3±7.8	-7.0
6	-1 HCO_3	*±	8.65±6.83	4.68±3.5	3.09±0.59	10.72±7.96	2.7±0.4	-3.6	2.1±0.3	1.8±0.5	3.4±1.5	9.1±5.8	2.3±0.6	-4.7
7	-1 C1	*±	50.3±21.82	7.66±10.3	52.81±41.06	29.87±16.0	16.9±9.4	-10.4	12.6±8.1	10.4±4.9	14.6±5.1	9.6±3.0	16.3±6.1	-11.1
8	-2 SO_4	*±	66.85±13.01	11.14±8.3	48.81±38.31	41.28±12.18	9.6±6.6	-6.5	7.6±0.9	26.0±18.5	21.8±20.9	9.6±2.8	8.9±1.8	-12.4
9	-2 CO_3	*±	-51.6	0	-3.2	-48.0	-1.2	0	0	0	0	-3.2	-2.2	0

*Standard error ±.

association. The stands show *D. bipinnatae* is dominant with constancy class V and *K. indica*, is differential species with constancy class II *D. annulatum, A. maurorum, Phalaris minor, Calatropis procera, C. dactylon, C. amibgua* with low constancy class are companion species. *R. dentatus*; *I. cylindrical, S. asper* and *Oligomeris glaucesens* are also present in fewthis community type are loam in nature. The details of the soil characteristic are given in Table 2.

Association 5: *Alhagietum maurorae*

In this plant community type *A. maurorum* with constancy class V is dominant. The differential species are *S. fruticosa*, *K. indica* which have low constancy class and cover abundance. *Paspalum distichum*, *Acacia arabica*, *P. monspleiensis*, *Melilotus indica, Scirpus maritimus, Conyza ambigua* and *P. abyssinica* are companion and rare species. However, *A. maurorum* are more frequently present on waste land, while *S. fruticosa*, *K. indica* are present only on saline soils. With the decrease in salinity level in the substrata the percentage occurrence and percentage cover of this species increase. The character species were seen abundantly present on many other waste lands with almost negligible amount of salt. Their floristic composition is given in Table 1. Soils of this community type are sandy loam in nature. The details of the soil characteristic are given in Table 2.

Association 6: *Sporoboletum arabicae*

The vegetation of this association consists of Sporobolus arabicus being dominant and constant. *K. indica* was also constant with percentage cover. *D. bipnnata, D. annulatum, C. dactylon, Medicago denticulata, Saccharum spontaneum, R. dentatus* are companion species with low constancy class. *S. arabicus* grows in non saline soil. It is also commonly found as a primary or secondary invader of saline soils, occurring with it are other salt tolerant species such as *S. fruticosa* while in the non saline soil it is associated with *D. annulatum, C. dactylon, Cenchrim* sp. *S. arabicus* may form dense nearly pure stands on borders of saline pans, where the mean salinity is nearly 5 m.mhos/cm. Their floristic composition is given in Table 1. Soils of this community type are sandy loam in nature. The details of the soil characteristic are given in Table 2.

Association 7: *Polypogaetum monspeliensae*

This association is characterized by dominance and constancy class V of characters of *P. monspeliensis*. Salinity indicating species as *K.*

Table 3. Domin-Krajina scale for percentage cover.

SN	Scale	Domin-Krajina	Percentage cover
1	10	Any number, with complete cover	100
2	9	Any number with more than 3/4 but less than complete cover	75
3	8	Any number, with 1/2 -3/4 cover	50-75
4	7	Any number, with 1/3 -1/2 cover	33-50
5	6	Any number, with 1/4 -1/3 cover	25-33
6	5	Any number, with 1/10 -1/4 cover	10-25
7	4	Any number, with 1/20 –1/10 cover	5-10
8	3	Scattered with cover under 1/20	1-5
9	2	Very scattered, with small cover	1
10	1	Seldom with insignificant cover	
11	+	Solitary, with insignificant cover	

indica, *S. fruticosa* (differential species) with class IV are sparsely present. The association is composed of non saline soil, but it is primary and secondary colonizer on slightly saline soil. This association is composed of three sub associations that is sub association, *Polypogaetum monspeliensae*, sub association *Erythraetosum ramosissma,* sub association, *A. maurorae*. The companion species are *P. minor, Erythrae ramosissma, A. maurarum, Polygonum plebjum, C. dactylon, Scirpus maritiumus, D. annulatum, Chenopodium murale* with low constancy class. Their floristic composition is given in Table 1. Soils of this community type are sandy loam in nature. The details of the soil characteristic are given in Table 2.

Association 8: *Erythraeo-polypogaetum-monspeliensae*

The vegetation of this plant community (12 Relev'es) consist of *E. ramosissma, P. monspeliensis* being dominant and constant. Two species have same constancy value. *Scirpus martimus*, *C. dactylon*, *D. annulaturn, Sporobolus phallidus*, *I. cylindrica, R. dentatus* are companion species. *E. ramosissma* and *P. monspeliensis* have been found growing in soils that are non saline. Their floristic composition is given in Table 1. Soils of this community type are sandy loam in nature. The details of the soil characteristic are given in Table 2.

Association 9: *Veteviarietum zyzanioides*

11 stands of different areas show the floristic composition of this association. The stands show *Veteveria zyzanioides* is dominant with constancy class V. *P. monspeliensis, E. ramosissma, D. annulatum, R. dentatus, C. ambigua, Euphorbia prostrate* are companion species. Their floristic composition is given in Table 1. Soils of this community type are sandy loam in nature. The details of the soil characteristic are given in Table 2.

Association 10: *Imperatetum cylindrieae*

The vegetation of this association (16 Relev'es) consists of *Imperata cylinderica* being dominant with constancy class V. This association shows that *K. indica* have constancy class V with low percentage cover. *D. annulatum, Launia* sp. *P. monspeliensis, E. ramosissma, C. dactylon, Conyza ambigua* are companion species. There are two sub associations named as *Imperatetosum cylindrieae* and *Dicanthietosum annulatae.* The plant community has a broad range of environmental tolerance since it occurs in soils ranging from wet marsh to dry road sides and prairie as well as physiological dry soil due to high toxic concentrations. It is dominant in comparatively wet and non saline soil. Sub association *D. annulatae* is characteristics of completely non saline and wet soil of mesic habitat. Their floristic composition is given in Table 1. Soils of this community type are sandy loam in nature. The details of the soil characteristic are given in Table 2.

Association 11: *Scirpetum maritimae*

21 Relev'es show that *S. martimus* is dominant with constancy class V *Kochia indica, R. dentatus, P. distichum, P. monspeliensis, S. asper, Phyla nodiflora, C. dactylon, S. spontaneum, E. ramosissma* are companion species. *S. maritimus* is usually of moist habitat. There are two sub associations that is, sub association *Sciretosum maritimae* and sub association *Polypogono-paspaletosum-distichae*. Their floristic composition is given in Table 1. Soils of this community type are sandy

loam in nature. The details of the soil characteristic are given in Table 2.

Association 12: *Typhetum angustitae*

15 stands of different areas showed floristic composition of this association. The stands showed *Typha angustata* is dominant with constancy class V and *S. fruticosa, P. monspeliensis, P. distichum, S. asper, S. oleraceus and S. martimus* are companion species with low constancy class. *Typha angustata* is of moist habitat. Their floristic composition is given in Table 1. Soils of this community type are sandy loam in nature. The details of the soil characteristic are given in Table 2. Figure 1 is indicating the various ranges of Salts in different associations described previously.

CLASSIFICATION

In addition to describing the structure, composition and inter-relationship of plant communities, the other aim of this work was to produce an inventory of vegetation types comparable with Zurich Montpellier school of thought. The classification of these units into a hierarchy involved several difficulties. One of the main difficulties was the non availability of local literature of community types from local habitats. Thus information had to be extracted from literature based on research carried out in places other than local habitats). Taking these difficulties into consideration and the classification proposed by different workers for the similar type of habitat, (Capman, 1958; Shimwell, 1971; Waisel, 1972; Adam, 1977; Mirza, 1978) as a base, the following classification of the halophytic communities of Ferozewala (District Sheikupura) is being proposed.

1) Cl. *Cakiletea maritimae*. R.Tx. et Preising 1950.
o. Thero-suaedetalia Br.— Bl et de, Bob's 1957. em. Beeftink 1962.
A. Thero - Suaedion. Br - Br - Bl 1931, 1933, em.
R. Tx. 1950.
Association Kochietum indicum. SuaedoKochietum hirsutae — Br. Bl. 1928.
Sub-association. *Kochietosum md icum*
Sub-association. *Desmostachyetosum bipinnatae*
Association. *Suaedum fruticosae*
Association. Diplacnnetum fuscae
Sub-association. *Diplachnetosum fuscae*
Sub-association. *Alhagetosum maurarae*
o. *Desmostachyetalia bipinnatae*
A. Desmostachyion
Association. *Desmostachyotum bipinnatae*
Association. *Alhagietum maurorae*
Association. *Sporoboletum arabicae*
Association. *Polypogaetum monspetierisae*
Sub-association. *Polypogoetosum monspeliensae*
Sub-association. *Erythraetosum ramosissmae*
Sub-association. *Aihagietosum maurorae*
Association. *Erythraeo polypoganetum* Monspeliensae
Association. *Vetevierietum zyzanioides*
Association. *Imperatum cylindrieae*

2. Cl. Phragnitetea Tux. et preg 1942.
o. Phragmitetalia (W. Koch) Tux et. Preg 1942.
A. Phragmition W. Koch 1926.
Association. *Scirpetum marimae*
Sub-association. *Imperataetosum cylindrieae*
Sub-association. *Dicanthietosum Annulatae*
Association. *Typhetum angustitae*

DISCUSSION

The case study has shown that in the Punjab salinity, sodicity and water logging are severe problems. This is a typical study of only one site (Tehsil Ferozewala of Sheikhupura District). Several such types of sites do exist somewhere else in the Indus basin. This study is only a small example to ascertain in the deteriorating effects of salinity and Sodicity on the soil, vegetation and ultimately on the income of the tree farmers/ Agro farmers. Growing crops (rice, wheat, cotton and rape seed) on the salt affected soils is less productive due to low yield and thus economically non viable. The growth of the perennial forage, salt tolerant grasses, Rhodes grasses, *Chloris gayana*, tall wheat grass (*Elytrigia elongate*) and Kallar grass (*Leptochloa fusca*) is economically viable, however, main focus should be on the economic utilization of the land while still in the saline and sodic conditions. Use of the agroforestry and integrating the farming systems (degrading versus sustaining farming systems) seems to be more profitable where ever possible alley farming (belts of tree, interspaced with alleys of crop land) is more economically useful. Trees act as biological pumps. There is need to reintegrate trees and shrubs back into agriculture landscape to reverse salinity such as *Atriplex amnicla, Tamarix aphylla, Phoenix dactilifera, Prosopis* spp*. Susbenia bispinasa, Susbenia sesbena, Casorina* sp*, Grewia asiatie, Psidium guava* etc. The incorporation of these plants (grasses, shrubs and trees) into agriculture land system of the Punjab has potential to increase crop, fiber, wood and animal production and degradation of land will also be halted.

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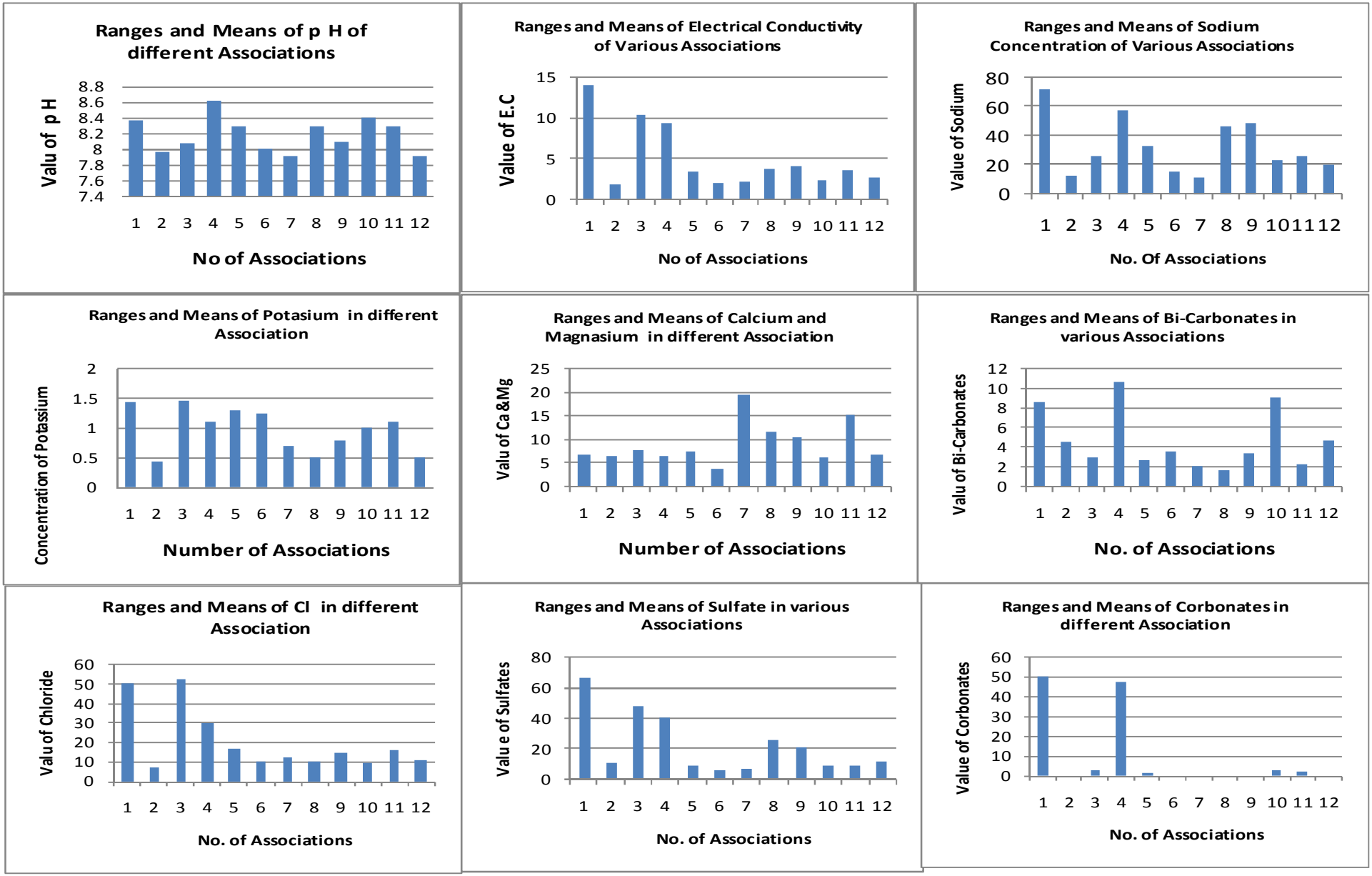

Figure 1. Showing the various ranges of salts in different associations.

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