QUANTITATIVE DESCRIPTION OF RAPIDLY CHANGING VEGETATION AROUND KARACHI

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Abstract

A phytosociological survey was conducted at 30 sites on different habitats i.e. tidal area, saline, waterlogged, dry stream, flat sandy, nalas and hard rocky areas around Karachi. Plant communities, importance values of some dominant species and absolute values of different stands were presented. Importance values of 1st three dominant species ranged from 43 to 271, 2nd dominant species from 29 to 75 while 3rd dominant species occupied from 22 to 57 importance values. Overall 83 different species were recorded in this study. Stand density ranged from 3839 plants ha-¹ to 15000 plants ha-¹, while cover ranged from 7.78 m²ha-¹ to 92.85 m²ha-¹. Stand density and cover not related significantly while it was positively significantly related in some species. Alien species *Prosopis juliflora* supersede native species completely in 4 stands occupying 1st dominant position in 8 stands captured 2nd dominant position in 7 stands while present as a 3rd dominant species in 4 stands. It is anticipated that this species not only enhanced its domination in sandy and hard surface area but invade saline and coastal areas slowly. Present investigation also compares floristic composition and plant communities of past to those at present. Anthropogenic disturbances is also a main reason to alternative communities with the aggressive behavior of *Prosopis juliflora.*

Introduction

Many workers analyzed vegetation of Sindh and Karachi. Chaudhri and Qadir (1958) analyzed sand dunes vegetation. Repp and Khan (1959) worked in Sindh while Champion *et al.,* (1965) placed vegetation of Karachi under Tropical swamp and tropical thorn forest. Chaudhri (1961); Qadir *et al.,* (1966); Qadir and Moinuddin (1968); Shaukat (1968); Shaukat and Hussain (1970); Karim (1970); Hamidul (1970); Shaukat and Qadir (1971); Ahmed (1973); Shaukat *et al.,* (1976); Ahmed *et al.,* (1978); Shaukat *et al.,* (1981); Iqbal *et al.,* (1983); Khan *et al.,* (2003) carried out quantitative vegetation analysis from different habitats of Southern Sindh. Structure, composition and above ground phytomass of some grass dominating communities of Karachi for summer and winter aspects have been investigated by Khan *et al.,* (1999) and Khan and Shaukat (2005). Shaukat *et al.,* (2014) presented phytosociological of Hub Dam catchment area, with reference to its structure, composition and diversity data. Mangroves areas were sampled by Saifullah and Rasool (2002) and Nazim (2012).

Hussain *et al*., (2010) presented a list of threatened trees, shrubs, undershrubs, herbs and climbers of Karachi. Several plants were reported to be rapidly going to be extinct due to anthropogenic disturbance. Plant communities of sandy areas of Karachi University was presented by Iqbal and Shafiq (1996). The status of vegetation analysis of Pakistan, including Sindh and Karachi was given by Ahmed *et al., (*2010). The floristic composition, structure, communities and plant quantitative values are rapidly changing. Natural vegetation which was an outcome of thousands of years of successional processes is rapidly changing by pollution, anthropogenic disturbances and obnoxious plants. Alien species have already altered the natural vegetation composition. The present investigation is aimed to explore the extent of change in communities, floristic composition and plants quantitative phytosociological values, which would be helpful for further research to determine biodiversity and food web of different habitats of Karachi.

Materials and Methods

A quantitative phytosociological survey was conducted in different habitats around Karachi. During this study one stand represented tidal area, 8 stands were from coastal to waterlogged habitats, 1 stand from small sand dunes, 12 stands from deep sandy flat soils, 6 stands from hard rocky surface and two stands from dry streams were included in survey, covering all possible habitats of Karachi. Salinity analysis of each stand was conducted using Multi Parameter Hanna Model HI 9828 in ppm.

After observing the clumped nature of vegetation in each stand ten rectangular quadrats (4x2 meter) were established after 30 meter distance, preferred by Greig-Smith (1964) and Barbour *et al.,* (1980).

Phytosociological attributes (Relative density, Relative frequency, and Relative cover) and absolute values were calculated according to the method described in Ahmed and Shaukat (2012). Each stand vegetation was characterized on the basis of importance value index and floristic composition and it was named on the basis of first three plants and it occupying highest importance value index following Brown and Curtis (1952). In case of equal importance value of herbs and shrubs in a stand, species of shrub was considered dominant over herb. Indicator plants of disturbance was mentioned in Ahmed (1973), following him in each stand native and obnoxious plants (aliens) were identified and their quantitative values were compared. For plants identification, Flora of Pakistan were followed.

Table 1. Summary of Phytosociological attributes.

Stand No.	First 3 dominant Species	IVI of first 3 dominant Species	No. of Species	Stand Density ha^{-1}	Stand Cover m^{2}ha^{-1}	Sub-dominant species 4th	Sub-dominant species 5th
1	*Pros.Juli-Capp. Deci-Comm. Wigh*	81-49-22	17	7000	43.19	*Tribulus terrestris*	*Euphorbia caducifolia*
2	*Aerv.pseu- Heli.cris-Blep.sind*	44-31-29	18	8750	26.21	*Cordia gharaf*	*Tribulus Terrestris*
3	*Capp.deci- Fago.indi-Euph.cadu*	70-33-26	23	9000	30.52	*Cressa cretica*	*Tephrosia Uniflora*
4	*Capp.deci-Grew.tena-Zizi.numm*	60-57-32	16	8500	40.15	*Tephrosia uniflora*	*Senna holosericea*
5	*Pros.juli-Suae.frut-Vach. nilo*	79-37-36	11	5250	60.93	*Capparis decidua*	*Cordia gharaf*
6	*Halo.stoc-Uroc setu-suae frut*	143-61-56	6	5625	9.76	*Arthrocnemum indicum*	*Heliotropium crispum*
7	*Uroc-setu -Halo stoc-Arth.indi*	141-73-57	4	9000	7.78	*Suaeda. Fruticosa*	-
8	*Tama.indi-Cres.cret-Desm .bipi*	94-69-44	8	14625	63.27	*Haloxylon stocksii*	*Suaeda fruticosa*
9	*Phra.kark-Aelu. lago-Typh lati*	63-27-27	13	9375	78.68	*Avicennia marina*	*Suaeda fruticosa*
10	*Pros.juli-Senn .holo-Fago indi*	43-34-32	21	14250	68.06	*Euphorbia caducifolia*	*Convolvulus prostratus*
11	*Zizi.numm-Pros.juli-Calo.proc*	46-37-30	22	15000	84.77	*Euphorbia caducifolia*	*Capparis decidua*
12	*Pros.juli-Capp .deci-Sals imbr*	125-75-33	7	4250	32.44	*Suaeda fruticosa*	*Cordia gharaf*
13	*Suae.fruc-Pros.juli-Capp. Deci*	103-68-64	6	4375	36.35	*Fagonia indica*	*Heliotropium crispum*
14	*Comm. wigh-Pros.juli-Sals .imbr*	96-73-42	7	4750	46.07	*Capparis decidua*	*Fagonia indica*
15	*Euph.cadu-Comm.wigh-Pros.juli*	98-48-41	11	9250	60.20	*Salsola imbricata*	*Lycium edgeworthii*
16	*Salv.pers-Tama .aphy.-Pros.juli*	74-44-42	11	8500	72.31	*Vachellia nilotica*	*Suaeda .fruticosa*
17	*Comm.wigh- Pros.juli-Pros.cine*	63-31-23	22	11375	92.85	*Euphorbia caducifolia*	*Fagonia indica*
18	*Capp.deci-Lyci.edge-Senn .holo*	58-47-25	20	110000	73.81	*Fagonia indica*	*Salsola imbricate*
19	*Euph .cadu-Comm. wigh -Pros.juli*	59-30-23	25	9000	64.75	*Pulicaria carnosa*	*Fagonia indica*
20	*Suae .mono-Uroc.setu*	260-40	2	5750	27.39	-	-
21	*Uroc. setu-Pros.juli*	271-29	2	8750	13.68	-	-
22	*Suae. imbr-Pros.juli- Fago .indi*	103-48-22	11	7375	38.84	*Suaeda fruticosa*	*Aerva javanica*

23	*Euph .cadu–Pros.juli-Comm .wigh*	156-42-23	9	5625	56.61	*Cleome viscosa*	*Salvia santolinifolia*
24	*Comm. wigh-Capp .deci-Euph .cadu*	70-39-27	15	7000	35.61	*Prosopis cineraria*	*Barleria prionitis*
25	*Salv. pers-Tama. indi-Halo. Ammo*	103-32-31	13	5875	45.64	*Senna Holosericea*	*Azadirachta indica*
26	*Euph.cadu– Pros.juli-Pros.cine*	77-39-22	21	9375	31.22	*Cynodon dactylon*	*Barleria prionitis*
27	*Euph.cadu- Comm.wigh-Pros.juli*	98-38-32	16	6625	56.46	*Leptadenia pyrotechnia*	*Prosopis cineraria*
28	*Avic.mari(pure stand)*	300	1	3839	26.78	-	-
29	*Sals.imbr -Heli.curr-Aerv java*	80-76-31	12	7363	32.91	*Halopyrum mucronatum*	*Fagonia indica*
30	*Pros.juli- Zizi.numm – Calo.proc*	101-65-33	16	4024	65.76	*Senna holosericea*	*Heliotropium ophioglossum*

Footnote: *Pros.juli: Prosopis juliflora; Capp. deci: Capparis decidua; Comm. wigh: Commiphora wightii; Aerv. pseu: Aerva psuedotomentosa; Heli. cris: Heliotropium crispum; Blep. sind: Blepharis sindica; Fago.indi: Fagonia indica; Euph. cadu: Euphorbia caducifolia; Grew. tena: Grewia tenax; Zizi. numm: Ziziphus nummularia; Suae. fruc: Suaeda fruticosa; Vach nilo: Vachellia nilotica; Halo stoc: Haloxylon stocksii; Uroc. setu: Urochondra setulosa; Arth. indi: Arthrocnemum indicum; Tama. aphy: Tamarix aphylla; Cres. cret: Cressa cretica; Desm. bipi: Desmostachya bipinnata; Phra. kark: Phragmites karka; Aelu. lago: Aeluropus lagopoides; Typh. lati: Typha latifolia; Senn. holo: Senna holosericea; Calo. proc: Calotropis procera; Sals. imbr: Salsola imbricata; Salv. pers: Salvadora persica; Pros. cine: Prosopis cineraria; Lyci. edge: Lycium edgeworthii; Suae. mono: Suaeda monoica; Tama. indi: Tamarix indica; Halo. ammo: Haloxylon ammodendron; Heli. curra: Heliotropium currassvicum; Aerv. java: Aerva javanica.*

Results and Discussion

Importance value index (IVI) of first three dominant species of each stand, absolute value of each stand, name of species occupying on 4th and 5th position on the basis of IVI and summary of phytosociological attributes are presented in Table 1. In all 84 species of plants were encountered in sampling. Details of each native and alien species recorded in present sampling i.e. presence in number of stands, its range and mean of density, cover and IVI are shown in Table 2. Location of stands and its habitats were described in the text. Sampling was carried out on different habitats around Karachi, each stand was described in its quantitative term. Stand vise distribution of IVI, density ha-^{1} and cover m^{2}ha-^{1} of native and alien species is shown in Fig. 1, Fig. 2 and Fig.3, respectively. Highest salinity (8.23 ppm) was recorded from tidal area (stand no. 28) while lower level (1.53 to 7.33) salinity was from waterlogged and saline area (stand no. 6, 7, 8, 9, 16, 20, 21 and 29). Further lower salinity was obtained from sandy area, i.e. 1, 3, 5, 10, 11, 12, 13, 14, 17, 18, 22 and 27 stands which was from 0.13 to 0.37 ppm. 0.13ppm salinity is obtained from stand number 2 which was small sand dune. Rocky and dry stream beds stands i.e. 4, 15, 19, 23, 24, 25, 26 and 30 showed lowest (0.12 - 0.30 ppm) amount of salinity.

Stand 1: This stand was located on deep sandy plains in Port Qasim area. Vegetation was dominated by *Prosopis juliflora* with highest I.V.I (81.33) and highest cover (19.70) m^{2}ha-^{1}. *Capparis decidua* was the second dominated with 12.07 m^{2}ha-^{1} cover. The third dominant species was *Commiphora wightii* on the basis of importance value while cover (6.30) m^{2}ha-^{1} was higher in *Euphorbia caducifolia*. On the basis of density and importance value *Tribulus terristris, Blepharis sindica, Lycium edgeworthii* and *Senra incana* are important associates with decreasing positions. Overall stand show 7000 plants ha-^{1} with 43.19 m^{2}ha-^{1} cover. If alien species *(Prosopis juliflora*) is eliminated from this stand, natural vegetation would take strength again. It seems that this stand used to be *Commiphora - Euphorbia - Capparis* community. First species was extensively taken by the local people for fuel purposes. Second species though represent calcareous area may also widely distributed in deep soil like this stand.

Stand 2: This highly disturbed community of *Aerva pseudotomentosa, Heliotropium crispum, Blepharis sindica* is located near different Banks on uneven small sand dunes, along the road side at Port Bin Qasim. Stand density ha-^{1} based on 8750 plants with small (26.21m^{2}ha-^{1}) cover. Plants were distributed in scattered form. *Cordia gharaf, Tribulus terristris, Convolvulus prostratus, Prosopis juliflora, Lycium edgeworthii, Fagonia indica,*

Zygophyllum simplex and *indigofera cordifolia* were important associates with decreasing importance values (from 27.71 to 11.44 I.V.I). *Prosopis juliflora* is also showing presence with moderate (21.32) importance values. *Cleome brachycarpa* was growing with 12 position with 9.28 IVI. *Cucumis prophetarum* and *Calotropis procera* occupied almost similar (7.42 to 7.85) IVI while *Citrullus colocynthis, Convolvulus prostratus* and *Abutilon indicum* were on last positions on the basis of importance value index. Highest density ha^{-1} (1375) with lowest (0.04) cover m^2ha^{-1} was occupied by *Blepharis sindica* while the species of highest cover (6.12) m^2 ha^{-1} and 875 individual ha^{-1} was *Aerva pseudomentosa*.

Stand 3: This stand was near Geolinks (Pvt.) Limited at Port Qasim situated on flat sandy plain. Here *Capparis decidua –Fagonia indica- Euphorbia caducifolia* established as a community showing 9000 plants ha^{-1} with 30.52 m^2ha^{-1} cover. *Heliotropium strigosum, Haloxylon stocksii, Aerva javanica, Tephrosia uniflora, and Cressa cretica,* occupied 11.18 to 16.88 importance values and 375 to 750 plants ha^{-1}. Due to a small size and wide distribution *Fagonia indica* attained highest relative frequency and relative density with 1375 individual ha^{-1}. *Zygophyllum simplex* and *Senna holosericea* showed 8.25 to 8.89 importance value index while *Maerua avenaria* and *Cadaba fruticosa* also exhibited similar (7.10 to 7.71) IVI. *Cleome brachycarpa, Lycium edgeworthii, Salvia santolinifolia, Barleria prionitis, Corchorus depressus, Convolvulus prostratus, Launea resedifolia,* and *Convolvulus rhyniospermus* were the other associates of this community with low IVI (5.56 to 6.76).

Stand 4: *Capparis decidua –Grewia tenax –Ziziphus nummularia* community was distributed on calcareous rock based surface near Steel Mill. This community was composed of 8500 plants ha^{-1} with 40.15 m^2ha^{-1} cover. *Corchorus depressus, Arthrocnemum indicum, Calotropis procera, Cordia gharaf, Indigofera cordifolia, Senna holosericea, and Tephrosia uniflora,* were widely distributed associates of the community with 10.15 to 21.72 importance values and 250 to 875 plants ha^{-1}. *Prosopis juliflora* is present with 13^{th} position in decreasing order of importance value. Aggressiveness of this species indicated that if not removed, it will suppress natural vegetation with time. *Senra incana* and *Convolvulus glomeratus* showed similar IVI on 11^{th} and 12^{th} positions respectively. *Prosopis juliflora* though occupied 13^{th} position but like other places it may increase its population rapidly. *Cressa cretica* and *Sida ovata* and *Aerva pseudotomentosa* were least distributed species of this community.

Stand 5: Near Paradise Point this stand was located on flat sandy surface. Here leading dominant species *Prosopis juliflora* forming a community with *Suaeda fruticosa* and *Vachellia nilotica* that were 2^{nd} and 3^{rd} dominant respectively. Community was composed of 5250 plants ha^{-1} with 60.93 m^2ha^{-1} cover. *Capparis decidua, Cordia gharaf, Haloxylon stocksii, Heliotropium crispum, Limonium stocksii, Aerva javanica and Ziziphus nummularia* attained 4^{th} to 10^{th} positions on the basis of decreasing importance values. *Suaeda fruticosa* have highest (1125 plants ha^{-1}) density with low (0.95 m^2ha^{-1}) cover. Leading dominant species of this stand *Prosopis juliflora* exhibited highest (26.45 m^2 ha^{-1}) cover. *Blepharis sindica* was growing with low (0.004 m^2ha^{-1}) cover, occupying the last (11^{th}) position in the stand regarding IVI.

Stand 6: *Haloxylon stocksii – Urochondra setulosa- Suaeda fruticosa* community was recorded at Hawksbay on flat saline area. Its 5625 plants ha^{-1} occupied low (9.76 m^2ha^{-1}) cover. *Arthrocnemum indicum* and *Heliotropium crispum* were on 4^{th} and 5^{th} positions on the basis of importance value. A few *Aerva javanica* were present showing a sign of disturbance. Highest density (1875 plants ha^{-1}) was occupied by *Urochondra setulosa* while the highest cover (5.41 m^2 ha^{-1}) was captured by *Haloxylon* stocksii.

Stand 7: Near Hawksbay a highly saline flat area was supporting *Urochondra setulosa-Haloxylon stocksii-Arthrocnemum indicum* community. *Suaeda fruticosa* was the associated species of this community. This stands occupied 9000 plants ha^{-1} with 7.78 m^2ha^{-1} cover.

Stand 8: Near Port Qasim, along the road side, a slightly slopy waterlogged and saline coastal area was supporting *Tamarix aphylla - Cressa cretica – Desmostachya bipinnata* community. Stand showed 14625 plants ha^{-1} with 63.27 m^2ha^{-1} cover. In this stand 4^{th} and 5^{th} dominant positions were occupied by *Haloxylon stocksii* and *Suaeda fruticosa* respectively. From the upper side of slope, *Prosopis juliflora* was penetrating in this saline community with 6^{th} position. Other associates were *Salvadora persica* and *Aeluropus lagopoides.* Highest density (6500 ha^{-1}) with lowest (0.005 m^2ha^{-1}) cover was with *Cressa cretica* while highest (31.76 m^2ha^{-1}) cover was captured by *Tamarix aphylla*. The vegetation of this site was reported by Ahmed in 1973 with no existence of Prosopis *juliflora.*

Stand 9: This sampling area was located near Steel Mill on a flat waterlogged area. Plants of this localized area were forming *Phragmites karka –Aeluropus lagopoides- Typha latifolia* community. *Avicennia marina* and

Suaeda fruticosa occupied 4th and 5th sub dominant positions while *Prosopis juliflora* was also competing with 6th position. *Phragmites karka, Typha latifolia, Avicennia marina, Cyperus rotundus* and floating plant *Lemna aequinoctiales* was sampled from shallow standing water while other associates like *Suaeda fruticosa, Launea procumbens, Suaeda monoica, Salvadora persica* and *Haloxylon stocksii* were growing on soil surface with gradually decreasing importance values. In this stand 9375 plants ha-¹ with 78.68 m²ha-¹ cover were recorded. *Tamarix indica* was also present with 12th position. This used to be a *Typha-Lemna* community (Ahmed, 1973). Other plants became the part of this community by the time, altering the floristic composition of this site.

Stand 10: This stand was closed to Dhabeji on flat sandy plain. This area was highly disturbed. Native plants i.e. *Euphorbia caducifolia, Ziziphus nummularia, Capparis decidua* and *Commiphora wightii* (Ahmed, 1973) reduced to 4th, 6th, 7th and 14th positions on the basis of importance value indexes. These native plants were reduced due to extensive cutting for fuel purposes. The community was formed by the alien species of *Prosopis juliflora* with *Senna holosericea* (2nd dominant) and *Fagonia indica* (3rd dominant). *Salsola imbricata, Calotropis procera, Zygophyllum simplex* and *Tribulus terristris* were other associates on 8th, 9th, 10th and 11th positions respectively. This stand support 21 different species with 14250 plants ha-¹ and 68.06 m²ha-¹ cover.

Stand 11: *Ziziphus nummularia –Prosopis juliflora – Calotropis procera* community was recorded on National Highway closed to Ghaghar Phatak on flat sandy plain. Community holds 22 plants species with 15000 plants ha-¹ and 84.77 m²ha-¹ cover. Native plants like *Euphorbia caducifolia, Capparis decidua, Commiphora wightii and Atriplex stocksii reduced* to 4th, 5th, 8thand 10th positions due to low importance values. *Salsola imbricata, Cadaba fruticosa, Heliotropium crispum, Fagonia indica, Cenchrus biflorus,* and *Senna holosericea* were associates with low (5 to 9.70) importance values. *Pulicaria carnosa, Indigofera cordifolia* and *Blepharis sindica,* attained similar (4 to 4.38) IVI while *Suaeda fruticosa* and *Grewia tenax* were present with low importance value index.

Stand 12: *Prosopis juliflora –Capparis decidua- Salsola imbricata* community was recorded on Northern By Pass Road near Al Habib Restaurant. The area was low land flat sandy portion of the land. Stand holded 4250 plants ha-¹ with 32.44 m²ha-¹ cover. Other associates were *Suaeda fruticosa, Cordia gharaf, Fagonia indica* and *Senna holosericea* occupying 4th to 7th sub dominant positions respectively. Low (7) number of species were recorded in this habitat may be due to the scanty rainfall of last two years.

Stand 13: This stand is also situated on low land flat sandy land like stand no 12. Only six plant species forming *Suaeda fruticosa- Prosopis juliflora –Capparis decidua* community with 4375 plants ha-¹ and 36.35 m²ha-¹ cover. Associated species included *Fagonia indica, Heliotropium crispum* and *Salsola imbricata* with 4th to 6th positions. Since *Ziziphus nummularia* was seen in many scattered form outside the sampling area it was anticipated that this may be *Capparis- Ziziphus* community. *Ziziphus* was taken for the fuel purpose and due to invasion of *Prosopis juliflora* and localized increased saline condition floristic composition was changed by the time.

Stand 14: *Commiphora wightii –Prosopis juliflora- Salsola imbricata* community was distributed along the Northern Bypass Road on hard flat surface. Community hold 4750 plants ha-¹ with 46.07 m²ha-¹ cover and only seven plants species. *Capparis decidua, Fagonia indica, Cenchrus biflorus* and *Senna holosericea* were holding 4th to 7th sub dominant positions respectively. In general 1st leading dominant species of this stand along with 5th and 6th positioned species prefer deep sandy soils. However, it may grow on shallow soil, according to Ahmed and Shaukat (2012).

Stand 15: *Euphorbia caducifolia- Commiphora wightii –Prosopis juliflora* community was sampled along the Northern By Pass Road near Kati Pahari with 9250 plants ha-¹ and 60.20 m²ha-¹ cover. The surface of the stand was flat and rocky, supporting eleven plant species. *Salsola imbricata, Lycium edgeworthii, Fagonia indica, Cressa cretica* and *Cynodon dactylon* occupying from 4th to 8th sub dominant positions respectively. *Senna holosericea, Zygophyllum simplex* and *Abutilon indicum* indicated from 9.49, 6.58 and 5.31 IVI respectively.

Stand 16: This stand was sampled near Karachi Airport on flat slightly water logged portion of the land. Number of species were restricted to eleven while density of stand was 8500 plants ha-¹ with 72.31 m²ha-¹ cover. *Salvadora persica – Tamarix aphylla - Prosopis juliflora* community was recognized in this area. On the basis of higher importance values. Now a rare native small tree species *Vachellia nilotica,* occupying 4th sub dominant position was recorded here. *Suaeda fruticosa, Ziziphus nummularia, Salvadora oleioides, Salsola imbricata, Cressa cretica* and *Tephrosia uniflora* were other associates with 5th to 10th sub-dominant positions respectively. *Limonium stocksii* distributed with low (3.98) IVI. This area used to be dry and sandy but due to

cutting of *Vachellia nilotica*, isolation, underground leaking of water pipes and absence of drainage system, gradually converted in water logged area.

Stand 17: Near National Highway closed to Ghaghar phatak, a flat sandy area was supported 22 plants species which occupied 11375 plant density ha-¹ and 92.85 m²ha-¹ cover .In this area a plant community was recognized as *Commiphora wightii –Prosopis juliflora –Prosopis cineraria.* A rare native small tree of Karachi, *Prosopis cineraria* is still surviving in this area. On the basis of decreasing importance values 4th sub dominant to 10th positions were occupied by *Euphorbia caducifolia, Fagonia indica, Salsola imbricata, Senna holosericea, Calotropis procera, Grewia tenax* and *Indigofera oblongifolia* respectively. On the basis of overall density this stand was number four but attained highest basal area in 30 stands. *Pulicaria carnosa, Panicum antidotale, Aerva javanica* and *Abutilon indicum* were distributed with 6.30 to 7.50 IVI. *Barleria acanthoides, Cordia gharaf, Atriplex stocksii* and *Boerhavia verticillata* showed similar importance value indexes while same was the case with *Cucumis prophetarum, Calligonum polygonoides* and *Lycium edgeworthii*. Largest size (small tree size) of *Commiphora wightii* was recorded in this area.

Stand 18: *Capparis decidua –Lycium edgeworthii –Senna holosericea* community was recorded on flat sandy surface, close to National Highway and 5 miles towards Ghaghar Phatak. This community contained 20 plants species having 11000 density ha-¹ and 73.81 m²ha-¹ cover. *Fagonia indica, Salsola imbricata, Ziziphus nummularia, Pulicaria carnosa, Prosopis cineraria, Prosopis juliflora* and *Calotropis procera* were recorded with 4th to 10th positions respectively. *Aerva javanica* (9.84), *Cordia gharaf* (7.15), *Grewia tenax* (6.81) and *Convolvulus glomeratus* (5.94) were associates with considerable IVI while other members of the community like *Zygophylum simplex, Rhus mysorensis, Indigofera oblongifolia* and *Heliotropium ophioglossom* were present with 4.05 to 4.85 IVI. Lowest value was shown by *Tribulus terristris*.

Stand 19: This stand was located behind Memon Goth with slopy, hard surface and plant density 9000 ha-¹ covering 64.75 m²ha-¹ cover. Twenty five plants species of this area forming a *Euphorbia caducifolia – Commiphora wightii- Prosopis juliflora* community. Other associates were *Pulicaria carnosa, Fagonia indica, Grewia tenax, Barleria acanthoides, Atriplex stocksii, Convolvulus glomeratus* and *Prosopis cineraria* with 4th to 10th sub dominant positions respectively. *Ziziphus nummularia, Cordia gharaf, Lycium edgeworthii and Indigofera oblongifolia* were the other members of the community with 9.13, 8.87, 7.73 7.80 IVI respectively. *Orbivestus cinerascens, Aerva javanica* and *Boerhavia verticillata* showed similar (6.54 to 6.89) IVI while same (5.07-4.72) was the case with *Capparis decidua* and *Zygophylum simplex*. *Rhus mysorensis, Pentatropis spiralis, Panicum antidotale, Heliotropium ophioglossum and Cadaba fruticosa* were growing with low (3.21 to 3.97) IVI.

Stand 20: This stand was located in Port Bin Qasim, near the Tomb of Muhammad Hussain Shah. Only *Suaeda monoica –Urochondra setulosa* community is found here with 5750 density ha-¹ and 27.39 m²ha-¹ cover. This was highly saline area. This area faces low tides occasionally. No other species is recorded in this highly saline and hard dark soil surface.

Stand 21: This community was also closed to previous site (Stand 20) here. *Urochondra setulosa* was forming community with *Prosopis juliflora*. No other species was recorded in that area. Alien species *Prosopis juliflora* was penetrating in this saline area, showing aggressiveness. Population shows 8750 density ha-¹ and 13.68 m²ha-¹ cover. The area was slightly slopy and faced occasional tides. *Prosopis juliflora* occupied low (29.41) IVI but it seems like other saline area will enhance its population with time.

Stand 22: This highly disturbed stand was situated near Hamdard University on flat sandy land, supporting only 11 species and 38.84 m²ha-¹ cover from 7353 density ha-¹. *Salsola imbricata – Prosopis juliflora – Fagonia indica* was the name of the community in this area. *Suaeda fruticosa, Aerva javanica, Euphorbia caducifolia, Cynodon dactylon, Blepharis sindica, Lycium edgeworthii and Calotropis procera* were associated from 4th to 10th sub dominant positions. *Cleome viscosa* was also distributed with low (11.94) IVI.

Stand 23: This stand was located on the way of Hub Dam on rocky hill surface. Only nine species were found in this area having 5625 density ha-¹ and 56.61 m²ha-¹ cover. About 81% of the total stand cover was occupied by leading dominant species *Euphorbia caducifolia.* In this area *Euphorbia caducifolia– Prosopis juliflora - Commiphora wighthii* community was recognized on the basis of quantitative sampling of the vegetation. *Cleome viscosa, Salvia santolinifolia, Boerhavia verticillata* and *Zygophyllum simplex* were associated from 4th sub dominant to 7th positions respectively. *Indigofera oblongifolila* and *Grewia tenax* were also the members of this community with 8.51 and 6.16 IVI respectively. *Commiphora wightii* was considered deep sandy soil species but present study does not agree, it may found widely on both deep and shallow soils.

Stand 24: *Commiphora wightii- Capparis decidua- Euphorbia caducifolia* community was established near Hub Dam on rocky hard surface, slope of a small hill with 7000 stand density ha-¹ and 35.61 m²ha-¹ cover. Fifteen plants species were recorded from this community. Rare native and small sized tree species *Prosopis cineraria* was distributed with 4th while *Cordia gharaf* and *Ziziphus nummularia* were on 8th and 9th sub dominant positions. Alien species *Prosopis juliflora* was competing as a six sub dominant species. *Lycium edgeworthii, Convolvulus prostratus, Aerva javanica* and *Zygophyllum simplex* were associated with 11.98, 11.75, 10.61 and 8.49 IVI with 10th to 13th positions respectively. *Convolvulus rhyniospermus* and a few *Cressa cretica* were also a part of this community.

Stand 25: This stand was sampled in Malir Nadi on National Highway where the ground surface was hard and rocky but in few patches waterlogged situation was formed. Thirteen plants species were recorded with 5875 plants ha-¹ and 45.64 m²ha-¹ cover. In this area *Salvadora persica - Tamarix indica – Haloxylon ammoderdron* community was established. Other associates were *Senna holosericea, Azadirachta indica, Calotropis procera, Boerhavia verticillata, Sporobolus arabicus* and *Grewia tenax* and *Fagonia indica* with gradually 4th to 10th sub dominant positions respectively. *Cleome brachycarpa, Sida ovata* and *Zygophyllum simplex* were present with almost similar (7.61, 7.64 and 7.65) IVI.

Stand 26: Vegetation of this stand was sampled in a dry Nala near Gharo. The surface of the ground was composed of hard lime stone bed which was supporting 21 different plants species with 9375 density ha-¹ and 31.22 m²ha-¹ cover. Vegetation of this area was named as *Euphorbia caducifolia – Prosopis juliflora –Prosopis cineraria.* Other members of the community were *Barleria acanthoides, Fagonia indica, Cleome brachycarpa, Tephrosia uniflora, Indigofera cordifolia* and *Sporobolus arabicus with* 4th to 10th sub dominant positions. In this stand *Prosopis glandulosa* was also recorded with low (5.96) importance values. *Salvadora oleoides* with 7.09, *Calotropis procera* (5.43) and *Senna holosericea* (4.46) IVI were associated with this community. Members of native plants i.e. *Ziziphus nummularia, Capparis decidua, Grewia tenax* and were also recorded with low (4.13- 4.62) values.

Stand 27: *Euphorbia caducifolia – Commiphora wightii – Prosopis juliflora* community was recognized near Super Highway on flat sandy plains. *Leptadenia pyrotechnica, Prosopis cineraria, Grewia tenax* and *Lycium edgeworthii* were occupied 4th, 5th, 8th and 9th sub dominant positions. Overall 16 plant species were recorded in this area with 6625 density ha-¹ and 56.46 m²ha-¹ cover. *Abutilon indicum, Fagonia indica, Indigofera cordifolia, Cleome brachycarpa, Convolvulus rhyniospermus* and *Atriplex stocksii* showed similar (6.58 to 6.82) IVI distribution while *Barleria acanthoides* was present with lowest (5.03) IVI in this community.

Stand 28: A stand of Mangrove species *Avicennia marina* was sampled behind WWF Office, Hawksbay. The stand holds 3839 density ha-¹ with 26.78 m²ha-¹ cover. The area located under tidal zone where mangrove species forming a single species dominating stand. Though coastal areas of Pakistan 4 mangrove species were recorded (Nazim, 2012) but *Avicennia marina* occupied 98% of the mangrove area (Nazim *et al*. 2010).

Stand 29: This highly disturbed stand was also located near stand 28, just bank of tidal zone at Hawksbay. Twelve plant species were recorded from this area i.e. *Salsola imbricata - Heliotropium currassvicum - Aerva javanica* community. *Halopyrum mucronatum* with 27.66, *Fagonia indica* 24.48 and *Avicennia marina* 21.06 importance value index were growing from 4th to 6th positions respectively. Communities have 7363 plants ha^{-1} with 32.91 m^2 ha^{-1} cover. *Zaleya pentandra* and few seedlings of *Arthrocnemum indicum* were also the part of this community with 13.29 and 13.06 IVI. *Atriplex stocksii, Crotalaria prostrata, Ipomoea alba* and *Cyperus rotundus* were also distributed with low (3.85- 3.05) importance value indexes.

Stand 30: *Prosopis juliflora- Ziziphus nummularia- Calotropis procera* community was recorded on slopy rocky surface of a small hill at Manghopir area. This community holds 4024 plants ha^{-1} with 65.76 m^2ha^{-1} cover from 16 plants species. *Senna holosericea, Heliotropium ophioglossum* and *Abutilon indicum* were growing on 4th, 5th and 6th positions with 15.45, 14.37 and 12.74 importance value index respectively. *Atriplex stocksii* occupying 9th position with 6.03 IVI. *Aerva javanica* and *Haloxylon stocksii* (9.57- 9.19), *Cucumis prophetarum, Corchorus depressus* and *Salsola imbricata* (5.65-5.21), *Tribulus terristris* and *Indigofera oblongifolia* (3.74-3.87) have similar IVI in this community.

Table 2. Species level summary of phytosociological analysis of study area.

S.NO	Species Names	Present In Stand Numbers	Native & Alien	Range Of Stand Density/ha			Range Of Cover m²/ha			Range Of I.V.I	
				Min	Max	Mean ± Standard Error	Min	Max	Mean ± Standard Error	Min	Max
1	*Abutilon indicum* (L.) Sweet	2,15,17,26,27,30	Native	59	375	217 ± 158	0.01	4.72	2.365 ± 2.355	4.81	12.74
2	*Aeluropus lagopoides* (L.) Trin.ex.Thw	8,9,27	Native	250	1500	875 ± 625	0.49	3.11	1.8 ± 1.31	6.58	27.45
3	*Aerva javanica* (Burm.f.)Juss ex J.A.Schultes	1,3,5,6,10,11,17,18,19,22,24,29,30	Alien	122	940	531 ± 409	0.01	1.64	0.825 ± 0.815	5.39	31.3
4	*Aerva pseudotomentosa* Blatt.& Hall.	1,2,4	Alien	125	875	500 ± 375	0.16	6.12	3.14 ± 2.98	5.64	44.16
5	*Arthrocnemum indicum* (Willd.) Moq.	4,6,7,29	Native	375	1750	1062.5 ± 687.5	0.35	1.64	0.995 ± 0.645	11.63	57.31
6	*Atriplex stocksii* (Boiss)	10,11,17,19,27,29,30	Native	59	625	342 ± 283	0.15	2.15	1.15 ± 1	3.85	10.43
7	*Avicennia marina* (Forrsk.) Vierh.	9,28,29	Native	375	3839	2107 ± 1732	0.69	26.78	13.735 ± 13.045	25.21	300
8	*Azadirachta indica* A.Juss.	25	Native	500	500	500 ± 0	1.29	1.29	1.29 ± 0	18	18
9	*Barleria acanthoides* Vahl	11,17,19,27	Native	125	500	312.5 ± 187.5	1.29	1.29	1.29 ± 0	3.97	7.71
10	*Barleria prionitis* L.		Native	250	1000	625 ± 375	0.2	1.74	0.97 ± 0.77	3.89	3.89
11	*Blepharis sindica* Stocks ex T. Anders	1,2,5,10,11,22	Native	250	1375	812.5 ± 562.5	0.004	0.28	0.142 ± 0.138	4.38	29.39
12	*Boerhavia verticillata* Poir	17,19,23,25	Native	250	500	375 ± 125	0.02	0.57	0.295 ± 0.275	4.15	16.34
13	*Cadaba fruticosa* (L.) Druce.	3,10,11,17,18,19	Native	125	375	250 ± 125	0.52	1.62	1.07 ± 0.55	3.97	7.71
14	*Calligonum polygonoides* L.	17	Native	250	250	250 ± 0	0.16	0.16	0.16 ± 0	3.89	3.89
15	*Calotropis procera* (Aiton) Dryand	1,2,4,10,11,17,18,22,26,30	Alien	125	1625	875 ± 750	0.01	8.96	4.485 ± 4.475	5.37	33.49
16	*Capparis decidua* (Forssk.) Edgew	1,2,3,4,5,10,11,12,13,14,18,19,24, 26	Native	125	1500	812.5 ± 687.5	0.07	22.67	11.37 ± 11.3	4.19	74.89

17	*Cenchrus biflorus* Roxb.	11,14	Native	500	750	625 ± 125	0.02	1.11	0.565 ± 0.545	9.7	17.99
18	*Citrullus colocynthis* (L.) Schrad.	1,2,26	Native	125	250	187.5 ± 62.5	0.02	0.25	0.135 ± 0.115	4.03	6.52
19	*Cleome brachycarpa* Vahl ex DC	2,3,25,26,27	Native	250	1000	625 ± 375	0.01	0.6	0.305 ± 0.295	5.56	16.88
20	*Cleome viscosa* L.	22,23	Native	375	500	437.5 ± 62.5	0.01	0.38	0.195 ± 0.185	11.94	20.02
21	*Commiphora wightii* (Arn.)Bhandari	1,10,11,14,15,17,19,23,24,27	Native	375	1875	1125 ± 750	1.34	30.39	15.865 ± 14.525	9.98	95.57
22	*Convolvulus glomeratus* Choisy	2,4,18,19	Native	125	375	250 ± 125	0.35	1.49	0.92 ± 0.57	5.47	10.31
23	*Convolvulus prostratus* Forssk	*2,3,10,24*	Native	250	1250	750 ± 500	0.29	2.72	1.505 ± 1.215	6.36	21.51
24	*Convolvulus rhyniospermus* Hochst.ex Choisy	3,24,27	Native	250	250	250 ± 0	0.15	0.46	0.305 ± 0.155	6.76	7.43
25	*Corchorus depressus* (L.) Stocks	3,4,10,30	Native	59	250	154.5 ± 95.5	0.1	1.94	1.02 ± 0.92	1.99	10.15
26	*Cordia gharaf (Forssk.)* Ehren ex Asch	2,4,5,12,17,18,19,24	Native	250	875	562.5 ± 312.5	0.29	3.27	1.78 ± 1.49	4.53	27.86
27	*Cressa cretica* L.	3,4,8,11,15,16,24	Alien	375	6500	3437.5 ± 3062.5	0.005	4.03	2.0175 ± 2.0125	7.95	69.45
28	*Crotalaria prostrata* Willd.	29	Native	108	108	108 ± 0	0.44	0.44	0.44 ± 0	3.33	3.33
29	*Cucumis prophetarum* L.	1,2,17,19,30	Native	58	250	154 ± 96	0.06	1.04	0.55 ± 0.49	3.96	7.42
30	*Cynodon dactylon* (L.) Pers.	15,22,26	Native	375	500	437.5 ± 62.5	0.22	3.83	2.025 ± 1.805	10.65	21.52
31	*Cyperus rotundus* L.	9,29	Native	108	500	304 ± 196	0.19	1.15	0.67 ± 0.48	3.05	11.8
32	*Desmostachya bipinnata* (L.) Stapf	8	Native	2000	2000	2000 ± 0	8.36	8.36	8.36 ± 0	43.56	43.56
33	*Euphorbia caducifolia* Haines.	1,3,10,11,15,17,19,22,23,24,26,27	Native	125	2125	1125 ± 1000	1.47	46.13	23.8 ± 22.33	17.7	156.3
	Fagonia indica Burm.f.	1,2,3,10,11,12,13,14,15,17,18,19, 22,24,25,26,27,29,30	Native	59	1375	717 ± 658	0.02	5.2	2.61 ± 2.59	4.66	36.04
35	*Grewia tenax* (Forssk) Aschers &Schweinf	4,11,17,18,19,23,25,26,27	Native	125	1750	937.5 ± 812.5	0.13	7.23	3.68 ± 3.55	2.98	57.34

36	*Halopyrum mucronatum* (L.) Stapf	29	Native	840	840	840 ± 0	3.25	3.25	3.25 ± 0	27.66	27.66
37	*Haloxylon ammodendron* (C.A Mey.)Bunge ex Fenzl	25	Native	375	375	375 ± 0	6.64	6.64	6.64 ± 0	30.92	30.92
38	*Haloxylon stocksii* (Boiss.) Benth. & Hook.	3,5,6,7,8,9,30	Native	59	1750	904.5 ± 845.5	0.42	6.13	3.275 ± 2.855	9.19	143.1
39	*Heliotropium crispum* Desf.	2,5,6,11,13	Native	250	875	562.5 ± 312.5	0.08	3.44	1.76 ± 1.68	6.44	31.23
40	*Heliotropium currassvicum* L.	29	Native	1590	1590	1590 ± 0	12.5	12.5	12.5 ± 0	75.74	75.74
41	*Heliotropim ophioglossom* Stocks ex Boiss	18,19,30	Native	122	250	186 ± 64	0.58	3.75	2.165 ± 1.585	3.9	14.37
42	*Heliotropium strigosum* Willd.	3	Native	375	375	375 ± 0	0.53	0.53	0.53 ± 0	11.18	11.18
43	*Indigofera cordifolia* Heyne ex Roth.	2,4,11,26	Native	250	500	375 ± 125	0.01	1.55	0.78 ± 0.77	4.1	14.52
44	*Indigofera oblongifolia* Forssk.	17,18,19,23,30	Native	59	375	217 ± 158	0.21	1.85	1.03 ± 0.82	3.87	8.51
45	*Ipomoea alba* L.	29	Native	108	108	108 ± 0	0.32	0.32	0.32 ± 0	3.29	3.29
46	*Lactuca serriola* L.	3	Native	250	250	250 ± 0	0.29	0.29	0.29 ± 0	6.36	6.36
47	*Launea procumbens* (Roxb.) Ramayya & Rajagopal	9,30	Native	59	500	279.5 ± 220.5	0.2	8.67	4.435 ± 4.235	4.04	21.35
48	*Launea resedifolia* (L.) O.Ktze.	3	Native	250	250	250 ± 0	0.33	0.33	0.33 ± 0	6.48	6.48
49	*Lemna aequinoctialis* Welw.	9	Native	875	875	875 ± 0	1.42	1.42	1.42 ± 0	21.14	21.14
50	*Leptadenia pyrotechnica* (Forssk.) Dcne	27	Native	375	375	375 ± 0	8.26	8.26	8.26 ± 0	25.84	25.84
51	*Limonium stocksii* (Boiss) Kuntze	5,16	Native	125	500	312.5 ± 187.5	0.14	0.28	0.21 ± 0.07	3.98	16.9

52	*Lycium edgeworthii* Dunal	1,2,3,10,15,17,18,19,22,24,27	Native	125	1625	875 ± 750	0.3	13.35	6.825 ± 6.525	3.44	46.7
53	*Maerua arenaria* (DC.) Hook.f. & Thoms.	1,3,26	Native	125	250	187.5 ± 62.5	0.35	0.92	0.635 ± 0.285	5.09	7.49
54	*Orbivestus cinerascens* (Sch.)Bip.) H.Rob.	19	Native	250	250	250 ± 0	0.34	0.34	0.34 ± 0	6.54	6.54
55	*Panicum antidotale* Retz.	17,19	Native	125	375	250 ± 125	0.42	1.84	1.13 ± 0.71	3.65	6.8
56	*Pentatropis spiralis* (Forsk.)	10,19	Native	125	375	250 ± 125	0.42	0.65	0.535 ± 0.115	3.65	6.41
57	*Phragmites karka* (Retz.)Trin.ex Steud.	9	Native	2125	2125	2125 ± 0	16.13	16.13	16.13 ± 0	63.16	63.16
58	*Prosopis cineraria* (Linn) Druce	17,18,19,24,26,27	Native	125	1000	562.5 ± 437.5	0.37	8.49	4.43 ± 4.06	10.17	24.8
59	*Prosopis glandulosa* Torr.	26	Alien	125	125	125 ± 0	0.62	0.62	0.62 ± 0	5.96	5.96
60	*Prosopis juliflora* (Swartz) DC.	1,2,,4,5,8,9,10,11,12,13,14,15,16, 17,18,19,21,22,23,24,26,27,30	Alien	125	2000	1062.5 ± 937.5	0.97	26.67	13.82 ± 12.85	8.48	125.2
61	*Pulicaria carnosa* (Boiss.) Burkill.	11,17,18,19	Native	250	750	500 ± 250	0.54	3.02	1.78 ± 1.24	4	19.45
62	*Rhus mysorensis* Heyre ex Wight & Arn.	18,19	Native	125	250	187.5 ± 62.5	0.13	0.49	0.31 ± 0.18	3.21	4.47
63	*Salsola imbricata* Forssk.	1,10,11,12,13,14,15,16,17,18,22,2 9,30	Alien	122	1800	961 ± 839	0.22	25.96	13.09 ± 12.87	5	103.1
64	*Salvadora oleoides Dcne*	10,16,26	Native	125	500	312.5 ± 187.5	0.97	4.72	2.845 ± 1.875	7.09	18.79
65	*Salvadora persica* L.	8,9,16,25	Native	250	1750	1000 ± 750	2.88	28.97	15.925 ± 13.045	11.82	102.6
66	*Salvia santolinifolia* Boiss.	3,23	Native	250	500	375 ± 125	0.15	0.25	0.2 ± 0.05	5.89	16.74
67	*Senna holosericea* (Fres.) Greuter	1,3,4,10,11,12,14,15,17,18,25,26, 27,30	Alien	125	2125	1125 ± 1000	0.01	7.5	3.755 ± 3.745	4.46	33.66
68	*Senra incana* Cav.	1,3,4	Native	250	625	437.5 ± 187.5	0.1	0.72	0.41 ± 0.31	7.76	12.73
69	*Sida ovata* Forssk.	4,25	Native	250	250	250 ± 0	0.02	0.05	0.035 ± 0.015	6.18	7.64
70	*Sporobolus arabicus* Boiss.	25,26	Native	375	500	437.5 ± 62.5	0.32	0.53	0.425 ± 0.105	8.32	15.88
71	*Suaeda fruticosa* Forssk ex J.F.Gmelin	5,6,7,8,9,11,12,13,16,22	Native	250	2000	1125 ± 875	0.35	7.57	3.96 ± 3.61	3.78	102.9

72	*Suaeda monoica* Forssk ex J.F.Gmelin	9,20	Native	500	4625	2562.5 ± 2062.5	3.18	26.4	14.79 ± 11.61	16.87	260.2
73	*Tamarix aphylla* (L.) *Karst*	8,16	Native	1250	3500	2375 ± 1125	10.1	31.75	20.925 ± 10.825	43.57	93.57
74	*Tamarix indica* Willd.	9,25	Native	375	500	437.5 ± 62.5	2.31	4.65	3.48 ± 1.17	11.94	32.04
75	*Tephrosia uniflora* Pers.	3,4,16,26	Native	500	875	687.5 ± 187.5	0.07	0.92	0.495 ± 0.425	10.92	21.72
76	*Tribulus terristris* L.	1,2,10,30	Native	59	1000	529.5 ± 470.5	0.12	1.42	0.77 ± 0.65	3.74	24.94
77	*Trichodesma indicum* (L.) R.Br.	3	Native	125	125	125 ± 0	0.36	0.36	0.36 ± 0	5.21	5.21
78	*Typha latifolia* L.	9	Native	750	750	750 ± 0	8.83	8.83	8.83 ± 0	26.72	26.72
79	*Urochondra setulosa* (Trin) C.E.Hubbard	6,7,20,21	Native	1125	8625	4875 ± 3750	0.99	11.09	6.04 ± 5.05	39.85	270.6
80	*Vachellia nilotica* (L) P.J.H. Hurter & Mabb.	5,16	Native	250	500	375 ± 125	14.51	14.85	14.68 ± 0.17	34.45	36.27
81	*Zaleya pentandra* (L.) Jeffrey	29	Native	590	590	590 ± 0	0.77	0.77	0.77 ± 0	13.29	13.29
82	*Ziziphus nummularia* (Burm.f.)Wight & Arn.	4,5,10,11,16,18,19,24,26,30	Native	125	2000	1062.5 ± 937.5	0.05	17.66	8.855 ± 8.805	4.13	65.25
83	*Zygophyllum simplex* L.	2,3,10,11,15,18,19,23,24,25,26	Native	125	1000	562.5 ± 437.5	0.01	0.88	0.445 ± 0.435	3.99	14.48

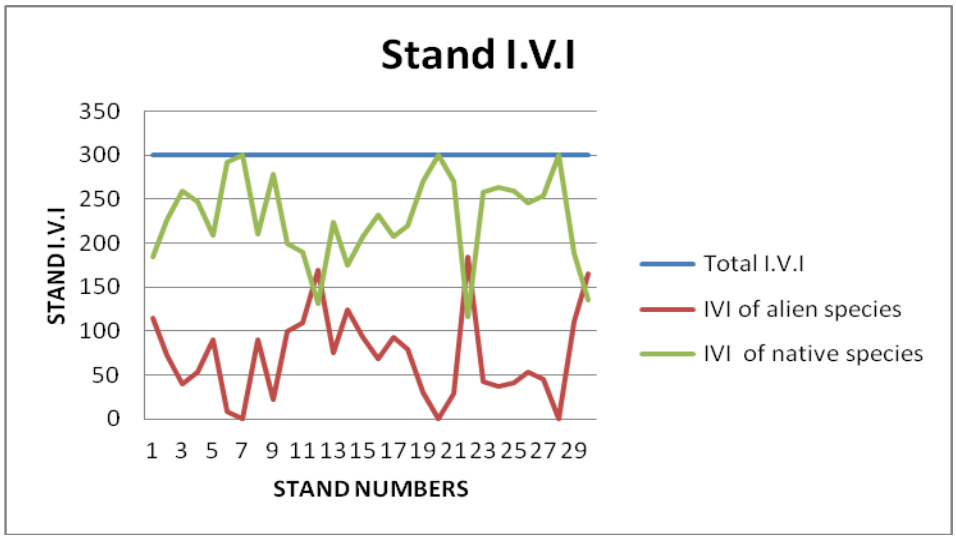

Fig. 1. Distribution of stand I.V.I between native and alien species.

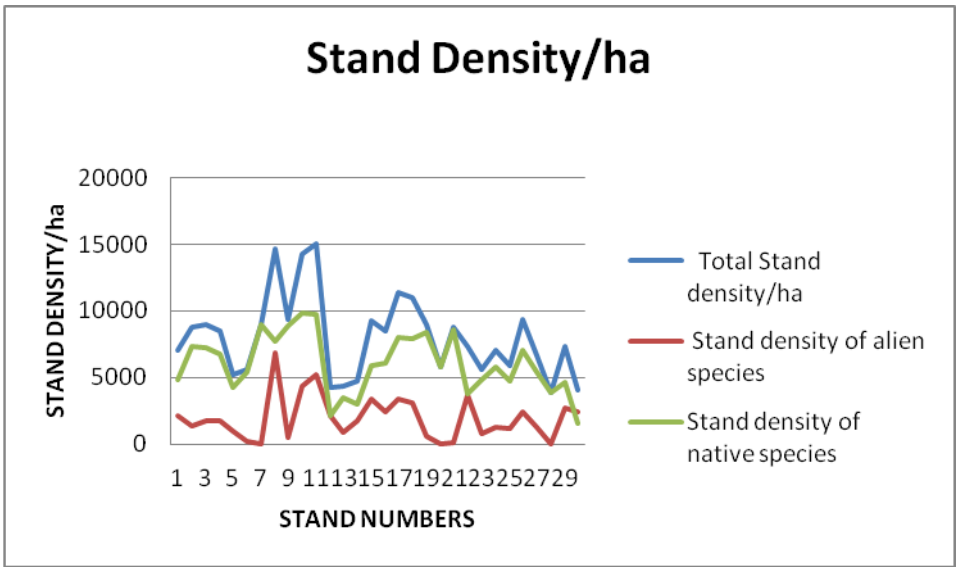

Fig. 2. Distribution of Stand density between native and alien species.

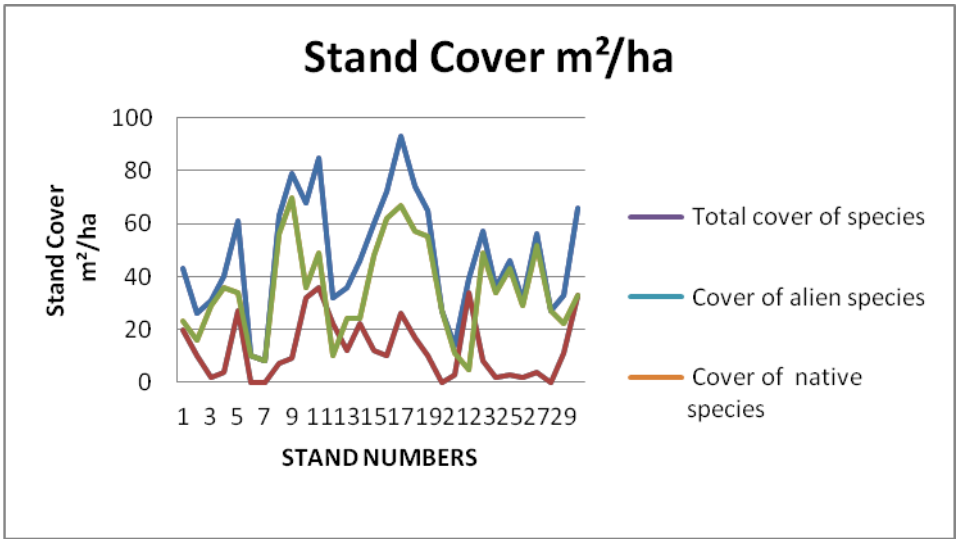

Fig. 3. Distribution of Stand cover between native and alien species.

It is shown by Fig. 1 to Fig. 3 that stand 7, 20 and 28 have no alien species due to its extreme habitat but *Prosopis juliflora* has capability to invade stand 21 in this habitat like other stands. In general these Figures also showed that native species occupied upper position than alien species, however in stands 12, 22 and 30 reverse was the case. Considering density stand number 12 and 30 are dominating with alien species (Fig.2) while in stands 6, 8, 22, 14 difference between native and alien species (Fig.3) was less. Unlike IVI and density, overall alien's species, cover seems more dominating or fairly close to native plants. (i.e. 13, 1, 5, 10, 11, 2, 29, 14).
Each and every stand was disturbed upto some level, due to increased population, urbanization, pollution, industries, cutting for fuel and grazing animals. However sampling was restricted to that area, with showing at some native plant species. Scanty rains of last two years (2014 and 2015) created a drought conditions in Karachi, therefore only 25 plant species were recorded in stands close to the agricultural field. However overall 83 species were recorded in sampling area while species distributed outside the sampling area were ignored. Overall stand density ranged from 3839 ha^{-1} to 15000 plants ha^{-1} and cover ranged from 7.78 to 92.85 m^2 ha^{-1}. Highest plant density was occupied by a small salt tolerant plant *Cressa cretica* (6500 ha^{-1}) while highest (46.13 m^2ha^{-1}) cover was attained by *Euphorbia caducifolia* (a latex- bearing plant) which was widely distributed in flat sandy plains to hard rocky flat or slopy surface. Due to combination of small trees, large/small shrubs and herbs stand density and basal area did not show significant relation. However individual species level density and basal area showed significant correlation in most cases.

In the last years many workers analyzed vegetation of Sindh including Karachi growing in diverse topography and habitats i.e. mangroves, coastal areas, sand dunes, saline and waterlogged areas, calcareous hills, dry stream bed (nala) and polluted industrial areas. Arid area species by Monsi (1958) unpublished, Monsi and Khan (1960) i.e. *Calligonum polygonoides* and *Prosopis cineraria* now show restricted distribution .Due to various development projects in Karachi University, communities reported by Qadir *et al.,* (1966) were eliminated. Various successional stages recognized by Shaukat (1968), Shaukat and Hussain (1972) were highly altered by alien species and now *Prosopis cineraria* was replaced by *Prosopis juliflora*.

Dominated species of calcareous hills of Shaukat and Qadir (1972) i.e. *Acacia senegal, Grewia tenax and Pulicaria hookeri* were now low in number. Ten associations recognized by Ahmed (1973) and Ahmed *et al.* (1978) around Karachi from different habitats were highly altered by anthropogenic disturbances, pollution and alien species.

As far as the tidal areas or mangrove areas are concerned due to its unique habitat and single domination, slightly change in absolute values i.e. density and cover were recorded by Nazim (2012). Waterlogged and saline areas were represented by waterlogged and salt tolerant species with change in floristic composition of species, change in dominant species and less quantitative values.

A native species of South America, Prosopis *juliflora* which was introduced in 1877 in Indian sub continent to Sindh (Muthana and Arora, 1983) is a drought resistant and fast growing (Tesfaye-abebe, 1994), depressing and removing our native flora. Many places it has completely replaced native plants due to its genetically approved quality, drought and up to some extent salt tolerance, no risk of grazing and disease, easy and fast germination of seeds (Khan *et al.,* 1987; Ahmed and Shaukat, 2012). *Prosopis juliflora* was the most widely distributed species found in 21 stands out of thirty it was occupying first leading dominant position in 5 stands, 2^{nd} in 8 stands, 3^{rd} sub dominant in 4 stands. Importance values along with its position in stand show the level and strength of distribution i.e. higher the Importance value higher the disturbance. This is the wasteland species (Prasad, 2009) able to grow and prosper in diverse topography, soil and habitat conditions; therefore it found competing with mangroves, found on saline areas, sand dunes, dry streams and hard calcareous surface. According to Khan, (1987) and Khan and Ahmad (1992) this species has drastically changed the physiognomy of our vegetation at many places all along the coast in various habitat types. In study area its density ranged from 125 plants to 1375 plants ha-¹ with 0.97 to 26.67 m^2 ha^{-1} cover.

In some saline communities *Aerva javanica* and *Prosopis juliflora* species may be seen and due to disturbances some strange floristic composition may be seen i.e. both species of *Salvadora, Tamarix* and *Vachellia nilotica* with species of higher saline area (*Suaeda fruticosa* and *Cressa cretica*) including alien species *Prosopis juliflora*. Similarly in sandy areas presence of *Cressa cretica* may indicate disturbance and localized salinity. In some flat lowland areas presence of high salt tolerant *Suaeda fruticosa* as a first dominant species and *Prosopis juliflora* second and *Capparis decidua* 3^{rd} dominant may show that the saline conditions of this area may be reduced by 2^{nd} and 3^{rd} dominant species and in future salinity and saline species may be replace by some other species or its presence show localized salinity after disturbance.

The characteristic species of calcareous hills, *Euphorbia caducifolia* (Shaukat, 1968; Ahmed and Shaukat, 2012) still dominating on hard, rocky calcareous surface but it was also one of the widely distributed species of deep sandy soil. Similarly, *Commiphora wightii* a sandy soil species may also be associated with aggressive *Prosopis juliflora* and hard shallow soil. This species was associated with *Euphorbia caducifolia, Barleria acanthoides, Pulicaria carnosa* (calcareous) with disturbed plants (Ahmed and Shaukat, 2012) i.e. *Prosopis juliflora*, *Salsola imbricata* and *Senna holosericea*. *Prosopis glandulosa, Calotropis procera, Abutilon indicum, Cressa cretica, Aerva javanica, Aerva pseudotomentosa* were also indicating disturbance .This community may

have climatic climax species, *Prosopis cineraria* as one of the dominant which would be replaced in future due to its cutting and aggressive growth and development of *Prosopis juliflora*. Recently Rab et al. (2016) studied vegetation of Karachi University without reporting any previously reported native species. This change was due to anthropogenic disturbance.

If stand density, native species and alien species density is considered, it seems that alien species have much lower density than native plants in saline area due to extreme habitat conditions. Only in sandy and rocky soil surface density of alien was increased, however overall high number of alien plants able to enter in deep sandy soil due to its favorable condition. Large sized alien species show low density and high cover. It is also concluded that alien species are rapidly increasing their density and cover.

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