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Quantitative Studies on the Vegetation of Islamabad

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Quantitative studies on the vegetation of Islamabad were conducted during spring-summer, 1998. Phytosociological observations were made and 17 plant communities were recognized in the area on the basis of highest importance value. *Acacia modesta* Wall. was the dominant tree of the study area, occurring as first dominant in 6 out of 17 stands, followed by *Broussonetia papyrifera* Vent. (first dominant in 3 stands), and *Dalbergia sissoo* Roxb.(first dominant in 2 stands). *Justicia adhatoda* L. was the dominant shrub (first dominant in 3 stands). It was observed that the original natural and xerophytic vegetation in the central areas has been changed into mesophytic type due to large-scale cultivation of trees.

Key words: Vegetation, Quantitative studies, Islamabad.

Introduction

Islamabad lies between 33°-36' to 33°-49' North and 72°-20' to 73°-24' East. The total area of Islamabad is approximately 382 sq. km. It lies in the northern corner of Potohar region, in the semiarid zone having hot summer and cool winter. The topography of the area especially the foothills, comprises mainly of eroded lands, farming lands and galleries. Most of the areas is Barani or rain-fed. Lithologically the area is highly dissected with moderate relief and the rocks of the Miocene age. In general, it is an uneven table land with alluvial and aconian deposits and bed rock out crops (Iqbal and Shah 1980). Rawal and Simli Dams are the main water reservoirs; there are some small streams moving down from the north to the south. Underground water conditions are moderate. The original vegetation of the area is subtropical scrub forest type (Champion *et al* 1965) while the flora of the area is an extension of the Mediterranean type (Stewart 1957).

Due to large-scale artificial addition the original vegetation is vanishing; at certain places, it has been totally replaced by exotic and ornamental species. The purpose of the study was to bring on record the quantitative and qualitative characteristics and distribution of the vegetation of Islamabad, which in the long run may be of great help to environmentalists, foresters and vegetation ecologists.

Many studies were made of the vegetation of various areas of Islamabad. For example Amin and Ashfaque (1982) have conducted studies on the Ayub National Park Rawalpindi and established five plant communities. Ahmad (1983) reported 793 dicotyledonous species from Islamabad. Amin *et al* (1984) studied the vegetation and soil of Lohibhar Range, Islamabad. Hijazi (1984) worked on the phytosociology of Margalla Hills National Park. Akber (1988) analyzed the vegetation of Quaid-i-Azam University campus. Khattak and Ahmad (1990) compared the vegetation of the north and south facing slopes of the Margalla hills. Ahmad (1991) reported that *Broussonetia papyrifera* Vent. was rapidly expanding in Islamabad. Ahmad (1993) conducted quantitative study on the weeds of wheat fields of Riwat area, Islamabad and reported 51 weed species from the area.

As is evident from the above survey, all of the studies were limited to specific regions whereas in the present study, the entire area of the Islamabad was taken into consideration.

Materials and Methods

Survey of the vegetation was conducted during the summer 1998. 17 stands were selected on the basis of physiognomy and uniform composition of the vegetation. Twenty quadrats were laid randomly in each stand, each for arborescent and understorey vegetation. For arborescent vegetation 10x10 m and for understorey vegetation 2x2 m quadrats were laid. The phytosociological attributes were noted for each species found in a stand. The plant specimens were collected, preserved, identified and deposited in the Herbarium of Pakistan Museum of Natural History, Islamabad and Quaid-i-Azam University, Islambad. For identification of the specimens, Flora of Pakistan (Nasir and Ali 1970) and other relevant literature were consulted (Stewart 1957, 1972; Nasir and Akhtar 1997).

The analytic characters calculated for each species in each stand were density (D), canopy cover (CC), frequency (F),

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and their relative values after Cox (1967), Mueller-Dombois and Ellenberg (1974), Brower and Zar (1977) and Greig-Smith (1980).

Importance value was calculated as (IV)= RD+RCC+RF

Where, RD = Relative Density
RCC= Relative Canopy Cover
RF = Relative Frequency

Results and Discussion

The data on three-storey vegetation showing first, second and third dominants of each community, their life forms and the importance values are summarized in Table 1. An average of 42 species was present in each of the stands, the maximum number of species being 50 (Islamabad graveyard), and minimum 30 species (Allama Iqbal Open University). Number of arborescent species varied from 2 (Police Line) to 13 (Saidpur), the average being 6 per stand. Shrubby species were more or less similar in frequency as trees. Herbs and grasses were the most frequent in all the stands, having an average of 29 species per stand. *Acacia modesta* Wall. was the dominant tree of the study area, occurring as first dominant in 6 stands, followed by *Broussonetia papyrifera* Vent. (first dominant in 3 stands) and *Dalbergia sissoo* Roxb.(first dominant in 2 stands). *Justicia adhatoda* L. was the dominant shrub (first dominant in 3 stands).

The central plain area was mostly covered with cultivated trees, having the dominance of *Broussonetia papyrifera* Vent. and *Dalbergia sissoo* Roxb., particularly in the green belts. *Broussonetia papyrifera* Vent., an introduced tree has become dominant in certain areas replacing the original vegetation. Trees like *Eucalyptus camaldulensis* Denh., *Cedrela toona* Roxb. ex Willd., *Albizia lebbek* (L.) Benth., *Mangifera indica* L., *Celtis eriocarpa* Dcne., *Platanus orientalis* L.,*Tecoma stans* (L.) Juss. ex H. B. & K. , etc. were common in the central areas (Table 2). Grasses like *Avena fatua* L. and *Phalaris minor* Retz were common in the spring season. *Taraxacum officinale* Weber. formed extensive carpet with yellow bloom in early spring along with *Euphorbia helioscopia* L. *Fumaria indica* (Hauss.) Pugs., *Lathyrus aphaca* L. *Stellaria media* (L.) Cyrill., *Vicia monantha* Retz., etc. *Cannabis sativa* L., *Conyza canadensis* (L.) Cronq., *Artemisia scoparia* Wald. ex Kitam., *Chenopodium album* L., were found gregarious in most parts of the central area. *Lantana camara* L.formed thick bushes around Shakarparian hills; this shrub is also replacing the original vegetation in many places. *Malvastrum coromandelianum* (L.) Garcke was seen in almost all parts of the area. Grasses like *Imperata cylindrica* (L.) Beauv., *Setaria pumila* (Poir.) Roem. & Schult., *Cenchrus ciliaris* L., *Dichanthium annulatum* (Forssk.) Stapf, and *Echinochloa crus-galli* (L.) Beauv. formed extensive patches after the monsoon rains. *Acacia modesta* Wall. was seen growing in stunted form among the dominant cover of *Broussonetia papyrifera* Vent. It appears that the latter will replace the original vegetation in several parts of the central areas.

The original vegetation was present at protected places at periphery of the area where the original, natural, vegetation comprised of *Acacia modesta* Wall., *A. nilotica* (L.) Delile, *Morus nigra* L., *Justicia adhatoda* L., *Zizyphus nummularia* (Burm.f.) Wight. & Arn., *Datura fastuosa* L., *Xanthium*

Table 1
Phytosociology and life form in 17 stands of Islamabad

Site	Community	No. of trees herbs, grasses	Total species	Type of vegetation	Life form			Importance value		
					1st	2nd	3rd	1st	2nd	3rd
Police Line (Central)	*Cynodon-Zizphus-Acacia*	2,2,37	41	Natural	HC,	MP,	NP	147.737	47.597	374.433
Green Belt H-9 (Central)	*Acacia-Dalbergia-Heteropogon*	9,4,39	52	Cultivated	NP,	NP,	HC	85.539	43.996	25.413
Green Belt G-10 (Central)	*Broussonetia-Dalbergia-Dactylochtenium*	9,5,27	41	Cultivated	MP,	NP,	HC	92.992	33.788	21.711
Sector G-10 (Central)	*Dalbergia-Bothrichloa-Broussonetia*	9,4,24	37	Cultivated	NP,	HC,	NP	75.432	30.682	32.115

(Table 1 cont'd.....)

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Karachi Company (Central)	*Justicia-Acacia-Cynodon*	3,2,35	40	Cultivated	NP,	HC,	NP	75.432	30.682	32.115
Sector F-7 (Central)	*Acacia-Broussonetia-Dalberga*	9,8,23	40	Cultivated	CH,	NP,	HC	78.256	64.639	16.239
Allama Iqbal Open University (Central)	*Albizzia-Cynodon-Iinperata*	3,2,25	30	Cultivated	NP,	NP,	NP	43.946	36.312	33.093
Islamabad Graveyard (Central)	*Dactyloctenium-Imperata-Setaria*	3, 3,44	50	Cultivated	HC,	HC,	HC	43.946	36.312	33.093
Blue Area (Central)	*Broussonetia Acacia-Dalbergia*	12,2,20	34	Cultivated	NP,	NP,	NP	53.765	52.109	41.692
American Embassy (Central)	*Broussonetia-Dalbergia-Acacia*	11,4,33	48	Natural	MP,	NP,	NP	118.839	26.227	24.057
Railway Crossing (Peripheral)	*Dalbergia-Themeda-Heteropogon.*	5,3,31	39	Cultivated	MP,	HC,	HC	109.625	39,285	32.267
Golra Sharif (Peripheral)	*Acacia-Morus-Albizia.*	9,7,33	49	Graveyard	MP,	MP,	NP	55.228	29.583	29.128
Dawer Sharif (Peripheral)	*Acacia-Desmostachya-Digitaria*	2,1,28	31	Graveyard	MP,	HC,	HC	81.279	35.754	32.521
Chontra (Margalla)	*Acacia-Zizyphus-Carissa*	3, 7,35	45	Natural	MP,	MP,	N	81.579	27.805	26.366
Saidpur Village (Margalla)	*Justicia-Mangifera-Acacia*	13,18,22	45	Natural	CH,	MP,	NP	55.338	31.229	18.142
Secretariat (Margalla)	*Acacia-Themeda-Pinus*	9,9,20	38	Natural	NP,	NP,	MP	67.831	26.468	22.975
Bari Imam (Margalla)	*Justicia-Broussonetia-Cynodon*	7,6,21	34	Graveyard	CH,	MP,	HC	43.478	35.326	21.788

Abbreviations used: NP, nanophytes; MP, mesophytes; CH, chamophytes; HC, hemicryptophytes.
Average: Total species = 42 per stand; Trees = 6 per stand; Shrubs = 5 per stand; Herbs/grasses = 29 per stand.

Table 2
Consolidated list of associated and dominant plants found in 17 stands of Islamabad

Trees:

Acacia modesta Wall.
A. nilotica (L.) Delile
Albizia lebbek (L.) Benth.
Bauhinia variegata L.
Bishoffia javanica Blume.
Bombax ceiba L.
Brachychiton populneum (Sch. & Endl.) R. Br.
Butea monosperma (Lam.) Taub.
Callistemon citrinus (Curt.) Stapf
Cassia fistula L.
Casuarina equisetifolia L.
Cedrela toona Roxb. ex Willd.
Celtis erioptera Dcne..
Citrus sinensis (L.) Osbeck
Ehretia serrata Roxb.
Eriobotrya japonica (Thunb.) Lindl.
Erythrina suberosa Roxb.
Eucalyptua camaldulensis Denh.
E. citriodora Hook.
Ficus bengalensis L.
F. palmata Forsk.
F. religiosa L.
Grevillea robusta A. Cunn.
Lagerostroemia indica L.
Mallotus philippensis (Lam.) Muell.
Mangifera indica L.
Melia azedarach L.
Morus alba L.
M. nigra L.
Olea ferruginea Royle.
Phoenix dactylifera L.
Pinus roxburghii Sarg.
Pistacia integerrima J.L. Stew. ex. Bran.
Platanus orientalis L.
Pongamia pinnata (L.) Pieree
Populus nigra L.
Prunus armeniaca L.
P. persica (L.) Batsch.
Psidium guyava L.
Pterospermum acerifolium Willd.
Punica granatum L.
Pyrus communis L.
P. pashia Ham. ex. D. Don
Salix acmophylla Boiss.
Sapindus mukorossi Gaertn.
Sapium sebiferum Roxb.
Schinus molle L.
Tecoma stans (L.) Juss. ex H.B. & K.
Terminalia arjuna Wight & Arn.
Thevetia peruviana (Pers.) Schum.
Woodfordia fruticosa (L.) S. Kurz.
Zizyphus nummularia (Burm. f.) Wight. & Arn.

Shrubs:

Asparagus adcsendens Roxb.
Barleria cristata L.
Buddleja asiatica Lour.
Buxus papillosa C.K. Schnied.
Calotropis procera (Willd.) R. Brown
Cassia occidentalis L.
Carissa opaca Stapf ex Haines
Cestrum nocturnum L.
Dodonaea viscosa (L.) Jacq.
Flacourtia indica (Burm.f.) Merrill
Hibiscus rosa-sinensis L.
H. syriacus L.
Holmskioldia sanguinea Retz.
Ipomoea carnea R. Brown
Jasminum grandiflorum L.
J. mesnyi Hance
Justicia adhatoda L.
Lantana camara L.
Maytenus royleanus (Wall. ex Law.) Cufod.
Nerium oleander L.
Nyctanthes arbor-tristis L.
Ocimum basilicum L.
Opuntia dilleni Haw.
Otostegia limbata (Benth.) Boiss.
Periploca aphylla Decais.
Rhamnus pentapomica Parker
Ricinus communis L.
Rosa indica L.
R. multiflora Thunb.
Sageretia thea (Osbeck) Johns.
Solanum incamum L.
Thuja orientalis L.
Typha angustata Chaub. & Bory.
Vitex negundo L.
Withania somnifera (L.) Dunal
Zizyphus oxyphylla Edgew.

Herbs:

Abutilon indicum (L.) Sweet
Achyranthes aspera L.

(Table 2 cont'd.....)

(Table 2 cont'd.....)

Aerva javanica (Burm.f.) Juss.
Ajuga bracteosa Wall. ex Benth.
Alternanthera pungens Kunth.
Alysicarpus bupleurifolius (L.) DC.
Amaranthus spinosus L.
A. viridis L.
Anagallis arvensis L.
Arenaria leptoclados (Reichn.) Guss.
Artemisia scoparia Wald. ex Kiatm.
Asphodelus tenuifolius Cavan.
Astragalus psilocentros Fisch.
Bidens biternata (Lour.) Merril & Sheriff
Boerhaavia diffusa L.
Brassica campestris L.
Buglossoides arvense (L.) Johns.
Calendula arvensis L.
Cannabis sativa L.
Capsella bursa-pastoris (L.) Medik.
Cardiospermum helicacabum L.
Carthamus oxycantha M. Bieb.
Centaurea iberica Trev. ex Spreng.
Chenopodium album L.
C. ambrosioides L.
Chrozophora obliqua (Vahl) A. Juss.
Cleome viscoa L.
Commelina benghalensis L.
Convolvulus arvensis L.
Conyza bonariensis (L.) Cronq.
C. canadensis (L.) Cronq.
Corchorus trilocularis L.
Coronopus didymus (L.) Smith
Cousinia prolifera Jaub. & Spach.
Crotalaria medicaginea Lam.
Cynoglossum lanceolatum Forssk.
Datura fastuosa L.
D. metel L.
Desmodium gangeticum (L.) DC.
Dicliptera bupleuroides Nees
Digera muricata (L.) Mart.
Echinops echinatus Roxb.
Eclipta prostrata L.
Epilobium hirsutum L.
Eremostachys vicaryi Benth. ex Hook.
Euphorbia helioscopia L.
E. hirta L.
E. prostrata Ait.
Evolvulus alsinoides (L.) L.
Fumaria indica (Hauss.) Pugs.
Galium aparine L.
Gastrocotyle hispida (Forssk.) Bunge
Gynandropsis gynandra (L.) Briq.
Heliotropium strigosum Willd.
Indigofera linifolia (L.f.) Retz.
Kickxia ramosissima (Wall.) Jans.
Lactuca serriola L.
Lathyrus aphaca L.
Launaea procumbens (Roxb.) Ram.& Raj.
Lepidium pinnatifidum Ledeb.
Linum corymbulosum Reichn.
Malva parviflora L.
Malvastrum coromandelianum (L.) Garcke.
Mazus pumilus (Burm. f.) van Steenis
Medicago polymorpha L.
Melilotus indica (L.) All.
Mirabilis jalapa L.
Nasturtium officinale R. Brown
Oenothera rosea L.
Oxalis corniculata L.
Polygala eorioptera DC.
Polygonum barbatum L.
P. plebeium R. Brown
Portulaca oleracea L.
P. quadrifida L.
Pupalia lappacea (L.) Juss.
Ranuncalus arvensis L.
R. muricatus L.
Rhynchosia minima (L.) DC.
Rumex chalepenis Miller.
R. nepalensis Spreng.
Saussurea heteromalla (D. Don) Hand.- Mazz.
Scandix pecten-veneris L.
Sida cordata (Burm.f.) Boriss.
Solanum nigrum L.
S. surattense Burm. f.
Stellaria media (L.) Cyrill.
Silybum marianum Gaertn.
Taraxacum officinale Weber
Tephrosia purpurea (L.) Pers.
Torilis leptophylla (L.) Reichb.
T. nodosa (L.) Gaertn.
Tribulus terrestris L.
Trichodesma indicum (L.) R. Brown
Verbascum thapsus L.
Verbena officinalis L.
V. tenuisecta Brig.
Vernonia cinerea (L.) Less.
Veronica polita Fries.
Vicia monantha Retz
Xanthium strumarium L.
Zaleya pentandra (L.) Jeffery

(Table 2 cont'd.....)

(Table 2 cont'd.....)

Grasses & Sedges:
Apluda mutica L.
Arundo donax L.
Avena fatua L.
Bothriochloa ischaemum (L.) Keng.
Brachiaria ramosa (L.) Stapf
Bromus japonicus R.R. Stew.
Cenchrus ciliaris L.
Cymbopogon jwarancusa (Jones) Roem. & Sch.
Cynodon dactylon (L.) Pers.
Cyperus rotundus L.
Dactyloctenium aegyptium (L.) Aschers.
Desmostachya bipinnata (L.) Stapf
Dichanthium annulatum (Forssk.) Stapf
Digitaria sanguinalis (L.) Scop.
Eechinochloa crus-galli (L.) Beauv.
Eleusine indica (L.) Gaertn.
Eragrostis papposa (Roem. & Sch.) Steud.
Eriophorum comosum Wall.
Heteropogon contortus (L.) Beauv.
Imperata cylindrica (L.) Beauv.
Lolium temulentum L.
Paspalidium flavidum (Retz.) A. Camus
Phalaris minor Retz.
Poa annua L.
Polypogon fugax Nees
Saccharum spontaneum L.
Setaria pumila (Poir.) Roem. & Schult.
Sorghum halepense (L.) Pers.
Sporobolus marginatus Hochst.
Themeda anathera (Nees) Hack.
Triticum aestivum L.
Urochloa panicoides P. Beauv.
Zea mays L.

Climbers:
Cissampelos pareira L.
Cissus carnosa (L.) Lam.
Cuscuta reflexa Roxb.
Porana paniculata Roxb.

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strumarium L., *Centaurea iberica* Trev. ex Spreng.. *Cousinia prolifera* Jaub. & Spach., *Carthamus oxycantha* M. Bieb., *Tribulus terrestris* L., *Solanum surattense* Burm.f, etc. (Table 2). Most of these species are spiny and unpalatable and are therefore spared by grazing animals. Grasses like *Apluda mutica* L., *Heteropogon contortus* (L.) Beauv., *Imperata cylindrica* (L.) Beauv., *Saccharum spontaneum* L., *Bothriochloa ischaemum* (L.) Keng., *Sorghum halepense* (L.) Pers., *Cynodon dactylon* (L) Pers., etc. were found in isolated patches that have escaped grazing somehow.

On the slopes of Margalla range scrub type of vegetation comprising mostly of *Dodonaea viscosa* (L.) Jacq., *Carissa opaca* Stapf ex Holmes, *Justicia adhatoda* (L.), *Zizyphus nummularia* (Burm.f.) Wight. & Arn, *Otostegia limbata* (Benth.) Boiss., *Olea ferruginea* Royle, *Maytenus royleanus* (Wall. ex Law.) Cufod., etc. were found. Thin grass layer indicated great grazing pressure in these areas. In Bari Imam, situated on the lower slopes of the Margalla range, severe degradation of vegetation has taken place because of constant biotic pressure. *Dodonaea viscosa* (L.) Jacq. was found covering large areas of the slopes. Herbs like *Alternanthera pungens* Kunth., *Crotalaria medicaginea* Lam., *Euphorbia prostrata* Ait., *Linum corymbulosum* Reichn., *Verbascum thapsus* L., were common in the Margalla foothills. Climbers like *Cissampelos pareira* L., and *Porana paniculata* Roxb. were also seen in the foothills.

From the results of the study it can be inferred that the original natural and xerophytic vegetation has been changed into mesophytic type due to large-scale cultivation. In spite of human settlement bulk of the vegetation has increased in Islamabad through cultivation and protection in the central areas.

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