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PLANT SUCCESSION ON ABANDONED FIELDS IN ASSIUT, EGYPT

Mohamad A. El-Sheikh

Department of Botany, Faculty of Science, Al-Azhar University (Assiut)

ABSTRACT :

Succession of the secondary growth of the plant communities in the abandoned fields inside Al-Azhar University campus at Assuit (constructed since 25 years ago) was examined, evaluated and discussed. The relationships between the environmental gradients, floristic composition, species richness, disturbance level and size structures of woody plants were assessed. Seventy-eight species were recorded: 46 annuals and 32 perennials. Four vegetation types were recognized after application of TWINSPAN, DCA and CCA techniques and named after their dominant species as follows: *Dichanthium annulatum-Pulicaria crispa, Pluchea dioscorides, Desmostachya bipinnata-Tamarix nilotica and Desmostachya bipinnata-Ziziphus spina-christi.* The notable environmental variables affecting the distribution of vegetation types in the study area were moisture content, disturbance level of stand, percentages of silt, clay and K.

INTRODUCTION:

Abandoned fields are usually open to natural succession and these successional changes depend on anthropogenic factors, which determine the dynamics of the physical habitat (Elias, 1984). Old-field succession provides a model system for testing plant response to disturbance frequency and intensity within a manageable time scale of a few years. Both disturbance frequency and intensity have been shown to affect competitive relationships, species richness, or the mix of early and late successional species in dynamic fields. Disturbance also determines, respectively, how often and how far succession can be reset (Armesto & Pickett, 1985; Goldberg, 1987; McConnaughay & Bazzaz, 1987; Carson & Pickett, 1990; Collins *et al*., 2001). One concern of the conservationists was that a great number of plant communities associated with the agricultural landscape were impoverished or eradicated and replaced by species-poor woodland communities (Brakenhielm, 2000).

The Egyptian Nile valley includes flat strips of cultivable land between the river and the cliffs of the desert on either side. Excluding plant communities in the extreme eastern and western deserts, the vegetation is mainly of weedy character and inhabits the arable fields, water bodies, ruderal habitats, marshes and swamps (Hassib, 1951). The uncultivated land (i.e. waste-land) has been described in many regional studies such as Kassas (1953), Tadros *et al.,* (1958), Hejny & Kosinova (1977), El-Sheikh

(1996) and Shaltout *et al*., (1999). The study of Shaltout (1994) focused on the post-agricultural succession in middle Nile Delta, while the study of El-Halawany (1999) evaluated the effect of fencing on the soil and vegetation composition in north Nile Delta.

The goals of this paper are to show how does the vegetation of the abandoned fields in Al-Azhar campus turn and change in terms of species diversity, expected plant communities, size-frequency distribution of the common woody plants, and to assess the effects of the environmental and disturbance variables on the vegetation composition and structure.

Study Site:

The study area lies at the north east of Assuit City (31°N and 27°E): Al-Azhar University campus (approx. 245 ha) which was constructed in the abandoned fields in 1974 (Fig. 1). Most of the site was fenced and changed into abandoned fields (buildings cover about 30 ha of the total area). The habitat disturbance inside the campus, included drying up the canals by closing water sources from River Nile, and hence changing the once cropped farmland into dry grassy and woody vegetation. Water may seep from adjacent fields, and the ground water is near (2 - 3 meters). By 1993, many wells were dug for the recultivation of parts of the area; therefore prevalent plant growth was disturbed by ploughing and cutting; and new wet microsites appeared. Some of the recent cultivated areas were abandoned again after two years of cultivation, which gave different stages of post agriculture successional microsites. Although the soil of the campus is muddy (formed of Nile alluvium) removing of large quantities of soil and introducing of the other soil types such as gravels, sand and ballast for building, modified the soil of many areas. This alluvium deposits laid down in Pleistocene and Recent geological periods which occupy the recent land surfaces (Hassib, 1951).

In the study area January is the coldest month with minimum and maximum air temperature of 7.0 °C and 20.6 °C, and June is the hottest with 21.5 °C and 38.0°C. Relative humidity varies between 24% in May and 50% in December, and evaporation varies between 7.0 mm day^{-1} in December and 22.3mm day^{-1} in June. The annual rainfall is sparse with *C.* 2.5 mm in February and long dry period in most months (the total annual amount is about 15 mm year^{-1}).

METHODS:

Thirty-nine stands (each of approx. 40x20 m size) were used to survey in the study site (34 of them inside the campus, and 5 outside for the comparison). The stands were distributed in the site so as to represent all the variation in the structure and age of the successional stages (Fig. 1). The sampling process was carried out during March 2000. The species were listed according to the nomenclature of Täckholm (1974), and Boulos (1995, 1999 & 2000). Seed and fruit dispersal types were evaluated according to the scheme of Dansereau & Lems (1957) which distinguishes dispersal types primarily by morphology of the diaspore. Disturbance was classified into 3 levels: high (level 1), medium (level 2) and low (level 3) as the levels described by Naveh & Whittaker (1979). In the (level 1), the sites were subject to clear cutting, digging and ploughing for recultivation. Medium (level 2), the sites are relatively stable: moderate disturbance by cutting but trampling and dumping of building refuse are recorded in it. Low (level 3), the sites are relatively or completely protected on the edges of the study area. Plant cover was estimated using line

intercept method (Canfield, 1941). TWINSPAN as a classification technique, and DCA as an ordination one, were applied to the cover estimates of 78 species recorded in the 39 stands (Hill, 1979*a,b*). The cover values of the indicator and associated species in relation to the environmental factors and disturbance levels were analyzed using Canonical Correspondence Analysis (CCA). The result is an ordination diagram in which points represent species and sites and arrows represent environmental variables (Ter Braak, 1987, 1988).

Species richness of each vegetation cluster was calculated as the average number of species per stand. Shannon-Weiner index ($\hat{H} = -\Sigma$ pi log pi) for the relative species evenness, and Simpson index ($C = \Sigma pi^2$) for the concentration of species dominance were calculated for each vegetation cluster on the basis of the relative cover (pi) of the species (Whittaker, 1972; Pielou, 1975). For each stand, all the individuals of the common woody species (i.e. shrubs and trees) were counted, their height (H) and mean crown diameter (D) (based on 2-4 diameter measurements/individual) were measured and their average height and diameter were calculated. Size index was calculated as follows: (H+D)/2 (modified from Crisp & Lange 1976). The size index values were used to calculate the size frequency distribution of the measured woody species. Density was calculated as individuals per 100 m^2. The mean and coefficient of variation of density, height and diameter and size index of each species were also calculated.

Three soil samples were collected at a depth of 50 cm from each stand. Soil texture was estimated using the Bouyoucos hydrometer method. Total organic matter was estimated by loss on ignition at 550°C. Soil water extracts (1: 5) were prepared for the determination of soil pH using pH meter, and soil salinity using a conductivity meter (mS cm^{-1}). Na, K, Ca were determined by flame photometer and Mg was determined by atomic absorption (Allen *et al.*, 1974).

One way analysis of variance (ANOVA-1) was applied to assess the significance of variation in the soil variables of stands supporting the vegetation clusters identified according to TWINSPAN technique. Relationships between the communities and soil variables were tested using the simple linear correlation coefficient (r). The probable environmental significance of the ordination axes (CCA) was investigated by the simple linear correlation analysis (SAS, 1985).

RESULTS:

The TWINSPAN classification of stands yields four clearly interpretable vegetation groups at the level 2. The characteristic species of these groups are *Dichanthium annulatum-Pulicaria crispa* (A), *Pluchea dioscoridis* (B), *Desmostachya bipinnata-Tamarix nilotica* (C) and *Desmostachya bipinnata-Ziziphus spina-christi* (D). In addition, there was a clear relationship between the four TWINSPAN groups and their position on the ordination plane of the first two axes of DCA (Table 1 and Fig 2a,b). The distribution of these clusters along DCA axis-1 revealed a clear gradient of disturbance level and moisture (from wet-high disturbed vegetation types to dry-low disturbed ones. *Dichanthium annulatum-Pulicaria crispa* cluster (A) had the widest distribution (17 stands=44% of the total stand) and represents the relatively recent disturbance vegetation type on the wet stands (the right side of the diagram). *Pluchea dioscoridis* cluster B had (10 stands = 26% of the total stands), represents the medium moist-disturbance gradients. On the other hand, *Desmostachya bipinnata-Tamarix nilotica* (5 stands=13% of the total stands) and

Desmostachya bipinnata-Ziziphus spina-christi (7 stands = 18% of the total stands) clusters (C and D) represent the low disturbed vegetation types on relatively dry stands (the left side of the diagram of DCA Fig. 2b).

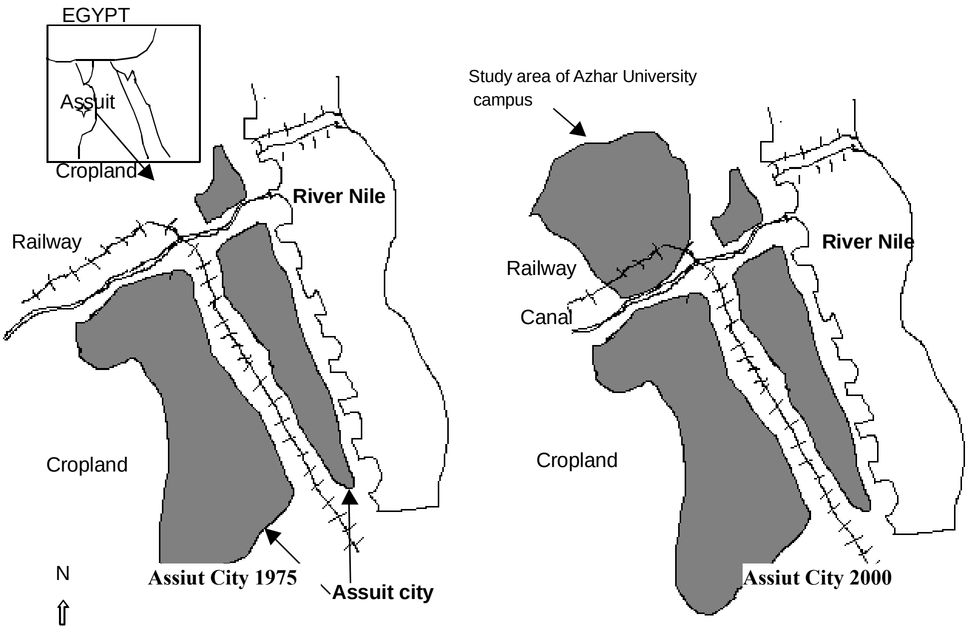
The values of correlation coefficients between the environmental factors and the axes for CCA ordination (Table 2) suggest that the separation of the species along the first axis is strongly influenced by the moisture gradient (r = 0.407) and disturbance level (r = -0.737). Silt and moisture correlated negatively with second axis (r = -0.382 and -0.316, respectively). The diagram of CCA (Fig. 3) showed that the moisture and disturbance are the most important factors related to the distribution of species in the study area. The therophytes of cluster A (_Dichanthium annulatum, Pulicaria crispa, Portulaca oleracea, Silybium marianum, Solanum nigrum_ and _Chenopodium murale_) coincided with the more degraded disturbed moist stands. Most perennial grasses and shrubs of clusters C and D (_Tamarix nilotica, Desmostachya bipinnata, Ziziphus spina-christi, Sesbania sesban, Acacia nilotica, Withania somnifera, Ricinus communis, Saccharum spontaneum_ and _Pluchea dioscoridis_) are correlated with low disturbed dry habitats.

The total number of the recorded species was 78, forty-five are annuals (57.7%) and thirty-three are perennials (42.3%). Annual and perennial herbs are the best represented (32 and 10, respectively), followed by annual and perennial grasses (9 and 8, respectively). _Dichanthium annulatum-Pulicaria crispa_ cluster (A) had the highest values of total annuals (38), total perennials (26) total species (65), total cover (127%,), species richness (16 spp/stand), and relative evenness (0.73), but the lowest of concentration of dominance (0.28). The species of this group are characterized by pogonochore, desmochore, sporochore and microsclerochore dispersal types (19, 10 and 11, respectively). _Pluchea dioscoridis_ clusters (B) had medium values of life forms and species diversity. On the other hand, _Desmostachya bipinnata-Ziziphus spina-christi_ cluster (D) had the highest values of tree/perennial ratio (46.2) and concentration of dominance (0.62), but the lowest of total annuals (2), total species (15), total cover (86%), species richness (6 spp/stand), species turnover (2.5) and relative evenness (0.36), and characterized by pogonochore dispersal type (Table 3).

Soil of _Dichanthium annulatum-Pulicaria crispa_ cluster (A) had the highest values of sand (55.5%), organic matter (3.4%) and Mg (23.3mg/100g). _Pluchea dioscoridis_ cluster (B) had the highest values of pH (7.98), salinity (1.4 ms/cm), silt (16.74%), Ca and Na (52.9 and 48.9 mg/100g, respectively) and the lowest of sand and clay (54.7 and 28.2%, respectively) and K (7.5 mg/100g). The _Desmostachya bipinnata-Tamarix nilotica_ cluster (C) had the highest values of K (6.1 mg/100g) and the lowest of salinity (1.0 mS/cm), O.M. (2.6%), Ca and Mg (38.8 and 12 mg/100g, respectively). _Desmostachya bipinnata-Ziziphus spina-christi_ (D) had the highest of clay (31.4%) and the lowest of pH (7.64), silt (11.7%) and Na (23.6 mg/100g) (Table 4). The study area (inside the Azhar campus) had high values of total cover, species richness, species turnover and relative evenness, and low value of concentration of dominance than outside (Table 5).

Diagrams illustrating the size distribution of six examined species (based on the values of their size index) indicate that _Ricinus communis_ was more or less positively skewed or inverse J-shape towards smaller individuals. On the other hand, _Pluchea dioscoridis_ and _Tamarix nilotica_ have negatively skewed distributions towards the large individuals, while _Pulicaria crispa_ had approximated a bell-shaped distribution. (Fig.

4). The height/diameter ratio was more than the unity for four species (Table 6) and less than the unity for *Pulicaria crispa* (0.63) and *Tamarix nilotica* (0.86). *Pulicaria crispa* and *Ricinus communis* had higher densities but lower individual size comparing with the other shrubs and trees (except *Acacia nilotica* which had a lower density).



a: Changes of Assiut city, black area represents building area.

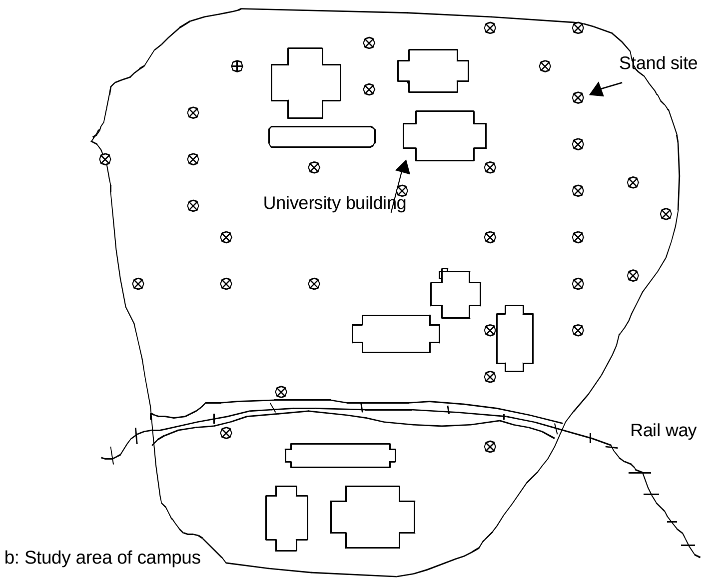


Fig (1) : Location map of Al Azhar University campus showing: a) changes of cropland for shifting cultivation in Assiut, during 1975 - 2000, b) study area and study sites.

a) TWINSPAN:

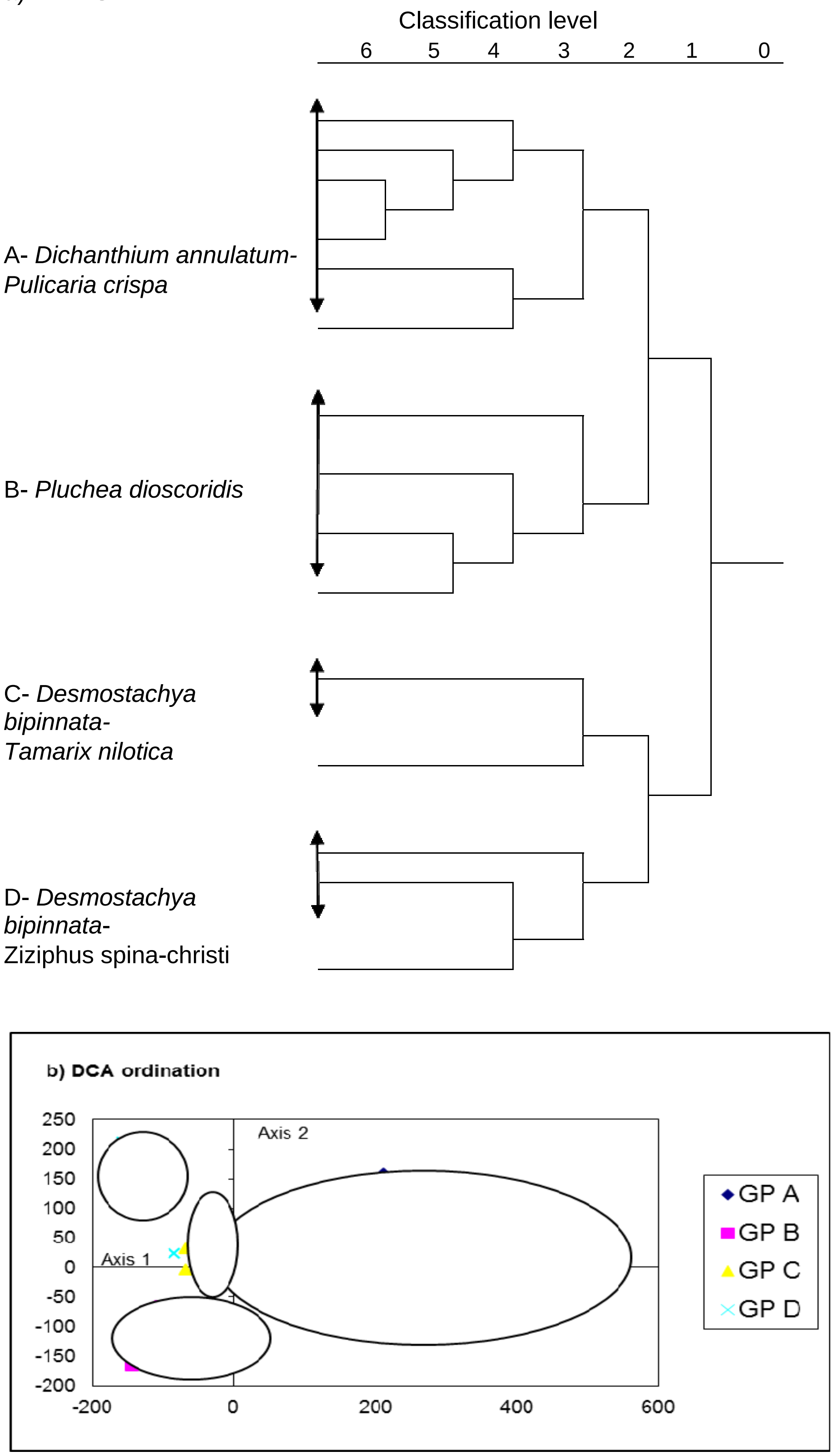


Fig. (2): Relation between the four vegetation groups resulting from the application

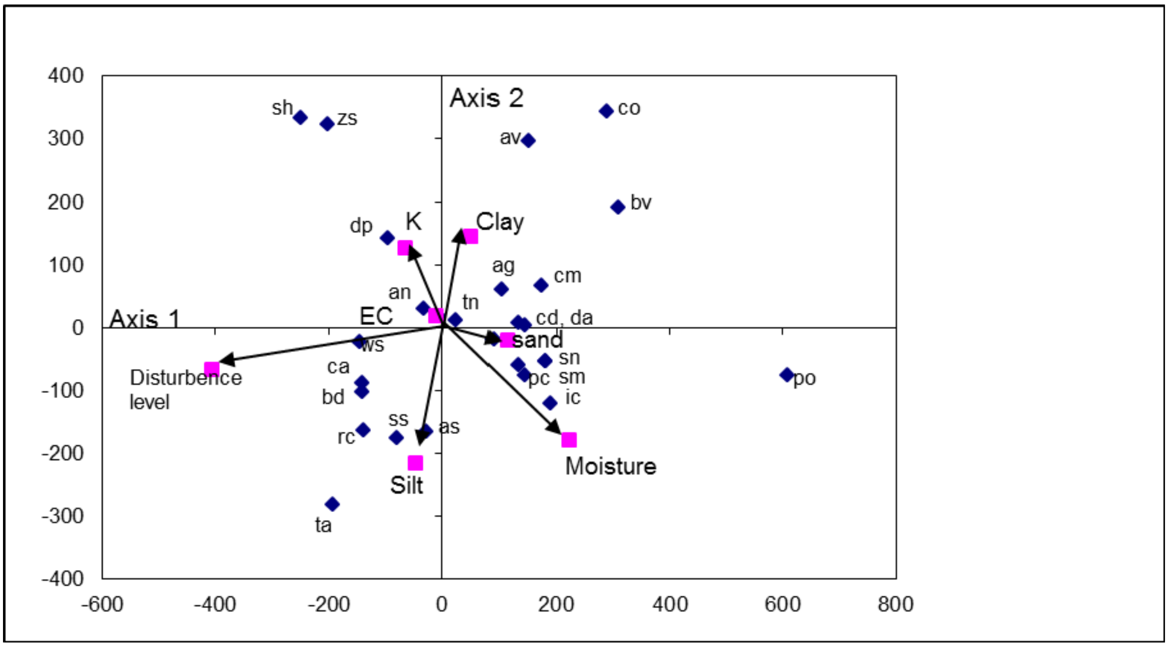


Fig. (3): CCA biplot with environmental variables (arrows) and the most abundant species represented by firstletter of genus and species name. For complete names of species see Table 1.

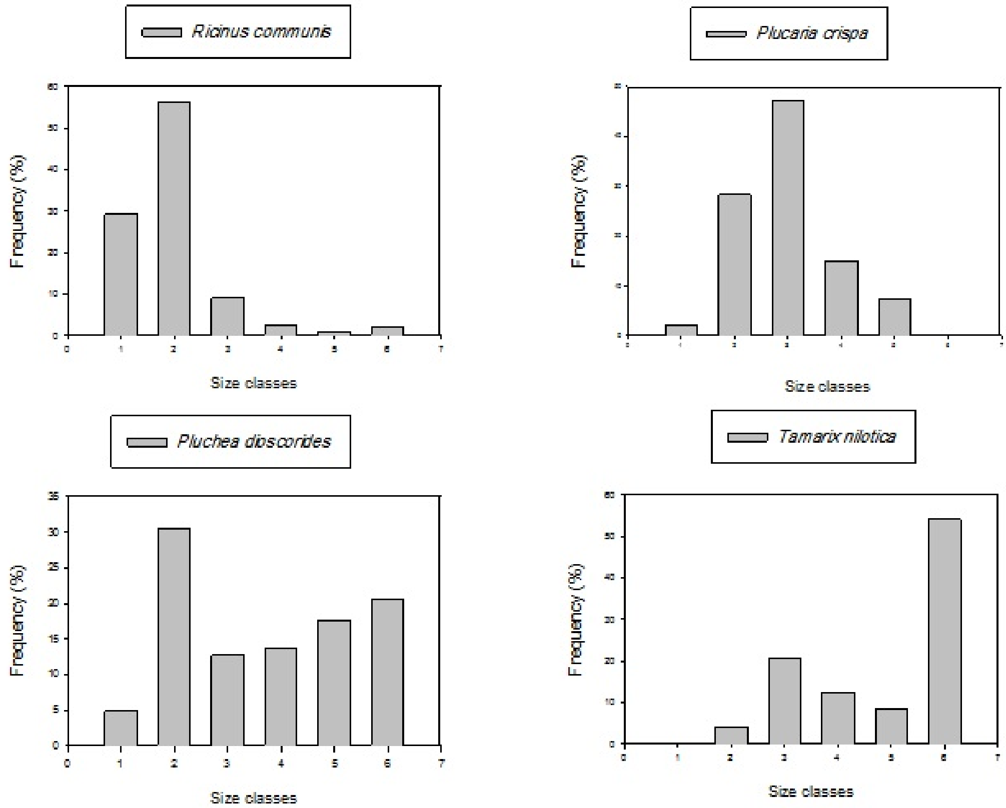


Fig. (4): Size-frequency distribution of the common shrubs and trees in the study area. The size classes (cm/ individual) are (1< 50, 2=100, 3=150, 4=200, 5=250, 6>250), except in the case of *Pulicaria crispa* (1< 25, 2=50, 3=75, 4=100, 5=125, 6>125).

Table (1): Mean cover (%) of the recorded species in the four vegetation groups drived after the application of TWINSPAN. The life forms are AH: annual herb, AG: annual grass, AF: annual forb, PH: perennial herb, PG: perennial grass, PF: perennial forb, PS: perennial shrub, TR: tree, SD: sedge and rush. The dispersal types are AU: auxochore, CY: cyclochore, PT:pterochore, PO: pogonochore, DE: desmochore, SA: sarrochore, SP:

sporochore, MI: microsclerochore, ME: megasclerochore, BA: ballochore. The vegetation groups are A: *Dichanthium annulatum- Pulicaria crispa*, B: *Pluchea dioscoridis,* C: *Desmostachya bipinnata-Tamarix nilotica* and D: *Desmostachya bipinnata-Ziziphus spina-christi.*

Species	Family	Life form	Dispersal type	Vegetation group			
				A	B	C	D
Pluchea dioscoridis	Compositae	PS	PO	4.6	54.4	5.4	12.1
Desmostachya bipinnata	Gramineae	PG	SP	8.4	2.9	38.1	47.8
Phragmites australis	Gramineae	PG	SP	0.5	2.6	4.8	1.0
Tamarix nilotica	Tamaricaceae	TR	PO	4.2	0.9	6.6	3.6
Pulicaria crispa	Compositae	PS	PO	13.0	2.5	2.6	1.2
Sliybum marianum	Compositae	AH	PO	10.5	1.0	0.02	
Ricinus communis	Euphorbiaceae	PS	DE	3.0	6.2	10.1	
Polypogon monspeliensis	Gramineae	AH	PO	1.2	0.3	0.1	
Dichanthium annulatum	Gramineae	PG	AU	21.4	6.2	1.8	
Cynodon dactylon	Gramineae	PG	AU	11.6	1.4	3.2	
Conyza bonariensis	Compositae	PH	PO	0.5	0.3	0.1	
Convolvulus arvensis	Convolvulaceae	PH	BA	0.9	0.8	0.2	
Acacia nilotica	Leguminosae	TR	ME	0.7	0.2		2.6
Cyperus rotundus	Cyperaceae	SD	AU	0.8	2.2		0.1
Phenoix dactylifera	Palmae	TR	SA	0.7	0.3		9.1
Ziziphus spina-christi	Rhamnaceae	TR	SA	0.2	0.01		9.0
Sesbania sesban	Leguminosae	TR	BA		2.5	2.3	0.2
Aster squamatus	Compositae	PH	PO	0.3	0.8		
Avena sterilis	Gramineae	AG	DE	0.4	0.03		
Avena fatua	Gramineae	AG	DE	0.1	0.4		
Chenopodium ambrosioides	Chenopodiaceae	PH	SP	0.1	1.1		
Chenopodium murale	Chenopodiaceae	AH	SP	2.5	0.1		
Chrozophora plicata	Chenopodiaceae	PH	SA	2.3	0.3		
Melilotus indicus	Leguminosae	AF	MI	0.9	0.1		
Portulaca oleracea	Portulacaceae	AH	MI	3.8	0.01		
Rumex dentatus	Polygonaceae	AH	DE	0.6	0.3		
Sonchus oleraceus	Compositae	AH	PO	1.4	0.7		
Trigonella glabra	Leguminosae	AF	BA	0.1	0.03		
Typha domingensis	Typhaceae	SD	PO	0.3	19.3		
Medicago sativa	Leguminosae	PF	MI	2.8	0.2		
Xanthium strumarium	Compositae	AH	DE	0.1	0.3		
Lactuca serriola	Compositae	AH	PO	0.2	0.1		
Ammi visnaga	Umbelliferae	AH	BA	0.2		0.2	
Chenopodium album	Chenopodiaceae	AH	SP	1.5		0.2	
Heliotropium supinum	Boraginaceae	AH	DE	0.6		0.2	
Lycoperscon esculntum	Solanaceae	AH	SA	0.03		0.1	
Polygonum equisetiforme	Polygonaceae	PH	MI	0.3		0.1	
Sonchus asper	Compositae	AH	PO	0.3		0.02	
Glinus lotoides	Molluginaceae	AH	MI	0.01		0.1	
Solanum nigrum	Solanaceae	AH	SA	0.7			0.1
Saccharum spontaneum	Gramineae	PG	PO	0.1			2.1
Avena barbata	Gramineae	AG	DE		0.1		
Brassica rapa	Cruciferae	AH	BA		0.1		
Bromus catharticus	Gramineae	AG	BA		0.02		
Eruca sativa	Cruciferae	AH	BA		0.01		

Table (1) Cont.

Species	Family	Life form	Dispersal type	Vegetation group			
				A	B	C	D
Phalaris minor	Gramineae	AG	PO		0.1		
Sorghum virgatum	Gramineae	PG	PO		0.1		
Amaranthus lividus	Amaranthaceae	AH	MI	0.2			
Beta vulgaris	Chenopodiaceae	AH	DE	0.8			

Cichorium endivia	Compositae	AH	PO	0.2			
Datura innoxia	Solanaceae	AH	BA	2.4			
Echinochloa colona	Gramineae	AG	DE	0.3			
Euphorbia peplis	Euphorbiaceae	AH	SA	0.4			
Arundo donax	Gramineae	PG	PO	0.01			
Imperata cylindrical	Gramineae	PG	PO	2.9			
Launaea nudicaulis	Compositae	PH	PO	0.1			
Medicago polymorpha	Leguminosae	AF	PT	0.8			
Malva parviflora	Malvaceae	AH	PT	0.1			
Phalaris paradoxa	Gramineae	AG	PO	0.6			
Polypogon viridis	Gramineae	AG	PO	0.1			
Sida alba	Malvaceae	PH	MI	0.1			
Sisymbrium irio	Cruciferea	AH	BA	0.02			
Tribulus terrestris	Zygophyllaceae	PH	DE	0.2			
Trifolium resupinatum	Leguminosae	AF	PT	3.1			
Echium rauwolfii	Boraginaceae	AH	DE	0.1			
Fumaria parviflora	Fumariaceae	AH	MI	0.1			
Ammi majus	Umbelliferae	AH	BA	0.1			
Amaranthus graecizans	Amaranthaceae	AH	MI	0.1			
Brassica nigra	Cruciferae	AH	BA	0.1			
Lolium perenne	Gramineae	AG	MI	0.1			
Heliotropium sp	Boraginaceae	AH	MI	0.1			
Urospermum picroides	Compositae	AH	PO	0.01			
Alhagi graecorum	Leguminosae	PF	BA			7.0	
Atriplex halimus	Chenopodiaceae	PS	MI			0.02	
Withania somnifera	Solanaceae	PS	SA			1.4	
Retama raetm	Leguminosae	PS	ME				0.1
Oxystelma alpine	Asclepiadaceae	PH	PO				2.3
Bidens pilosa	Compositae	AH	PO				0.02

Table (2) : Interest simple linear correlations ® of environmental variables with CCA- axes.

Variables	Axis 1	Axis 2	Axis 3
pH	0.080	-0.111	-0.312
Moisture content (%)	0.407**	-0.316*	0.188
EC mS/cm	-0.016	0.032	0.138
Sand (%)	0.209	-0.036	-0.270
Silt (%)	-0.084	-0.382*	0.221
Clay (%)	0.094	0.259	0.208
Organic matter (%)	0.073	-0.163	0.463
Calcium (mg/100 g)	-0.059	0.066	0.163
Sodium (mg/100 g)	-0.045	-0.071	0.039
Potassium (mg/100 g)	-0.116	0.227	-0.061
Magnesium (mg/100 g)	0.121	0.060	-0.054
Stand age (year)	-0.737***	-0.119	0.048

*** = < 0.05, **= < 0.01, *** =< 0.001.**

Table (3): Characteristics of the four vegetation groups identified in the study area. The vegetation groups are A: *Dichanthium annulatum- Pulicaria crispa*, B: *Pluchea dioscoridis,* C: *Desmostachya bipinnata-Tamarix nilotica* and D: *Desmostachya bipinnata-Ziziphus spina-christi.*

Character	Vegetation group				
	A	B	C	D	Total
Life form:					
Annual herbs	29	10	8	2	32
Annual grasses	5	5	-	-	9
Annual Forbs	4	2	-	-	4
Total annuals	38	17	8	2	45
Perennial herbs	9	5	3	1	10
Perennial grasses	7	5	4	3	8

Perennial Forbs	1	1	1	-	2
Perennial sedge & rushs	2	2	-	1	2
Perennial shrubs	3	3	5	2	5
Trees	4	5	2	6	6
Total Perennials	26	21	15	13	33
Tree/perennial (%)	15.4	23.8	13.3	46.2	18.2
Species diversity:					
Total species (%)	65	38	23	15	78
Plant cover (%)	127	113	82	86	102
Species richness (spp/stand)	16	8.5	7	6	9.4
Species turnover	4.1	4.5	3.3	2.5	3.6
Relative evenness (H')	0.73	0.49	0.53	0.36	0.53
Concentration of dominance (C)	0.28	0.43	0.39	0.62	0.43
Dispersal type:					
Auxochore	3	3	2	1	3
Pterochore	3	-	-	1	4
Pogonochore	19	12	7	6	23
Desmochore	10	6	2	-	11
Sarcochore	6	3	2	3	7
Sporo & Microsclerochore	11	7	3	2	18
Megasclerochore	1	1	-	1	1
Ballochore	7	6	4	1	11

Table (4): Mean±standard deviation of the soil characters of the stands supporting the four vegetation groups identified in the study area. The characteristic species of these groups are: A: *Dichanthium annulatum- Pulicaria crispa*, B: *Pluchea dioscoridis,* C: *Desmostachya bipinnata-Tamarix nilotica* and D: *Desmostachya bipinnata-Ziziphus spina-christi.*

Soil variable		Vegetation group				
		A	B	C	D	Mean
PH		7.64±0.85	7.98±0.84	7.87±1.0	7.64±0.86	7.75
EC mS/cm		1.3±1.1	1.4±1.0	1.0±0.3	1.1±0.5	1.20
Sand	%	55.5±4.2	54.7±6.0	55.0±9.7	55.4±13.1	55.2
Silt	%	14.7±5.2	16.7±5.3	15.6±9.2	11.7±5.9	14.8
Clay	%	29.8±4.0	28.2±0.7	29.2±2.3	31.4±6.1	29.6
Org. matter	%	3.4±0.7	3.3±1.6	2.6±1.3	2.9±1.2	3.2
Ca	Mg/1009	46.9±36.1	52.9±39.1	38.8±15.6	46.1±30.0	47.2
Na	Mg/1009	44.4±44.0	48.9±40.6	33.3±11.9	23.6±8.9	40.4
K	Mg/1009	12.1±17.8	7.5±4.5	16.1±13.4	10.6±11.8	11.1
Mg	Mg/1009	23.3±18.8	19.5±16.1	12.0±5.2	20.2±23.5	20.3

Table (5): Mean ± standard deviation of some community variables inside and outside the study area.

Community variable	Inside the campus	Outside the campus
Total cover (%)	107.1±34.5	95.1±23.8
Species richness (spp/stand)	11.0±5.7	5.2±1.0
Species turnover	6.8±0.0	3.5±0.0
Relative evenness	0.59±0.21	0.48±0.2
Concentration of dominance	0.39±0.18	0.42±0.2

Table (6): Mean and ± coefficient of variation of some demographic variables of the common shrubs and trees in the study area.

Species	Density ($Ind/100m^2$)	Height	Diameter	Size index	H : D ratio	Volume (m^2/ind)	
		(cm/ind)				Mean	Range
Shrub:							
Pulicaria crispa	7.9	47.5±0.38	75.2±0.48	61.4±0.43	0.63	0.31±1.3	0.009-1.5
Ricinus communis	36.9	102.6±0.57	39.4±0.97	71.0±0.77	2.60	0.52±5.1	0.0007-31.3

Pluchea dioscoridis	**8.4**	**181.8±0.48**	**163.2±0.88**	**172.5±0.68**	**1.11**	**10.2±2.3**	**0.1-98.9**
Tree:							
Acacia nilotica	**1.9**	**269.5±0.64**	**259.3±0.56**	**264.4±0.66**	**1.03**	**24.5±1.3**	**0.0034-110**
Tamarix nilotica	**4.2**	**277.5±0.55**	**324.3±0.61**	**300.9±0.58**	**0.86**	**305.7±1.9**	**0.19-196.0**
Sesbania sesban	**2.3**	**324.6±0.35**	**296.6±0.52**	**310.6±134**	**1.09**	**31.3±1.0**	**0.30-98.1**
Zizphus spina-christi	**1.3**	**491.4±0.46**	**419.6±0.78**	**455.5±0.62**	**1.17**	**1380±1.2**	**0.79-4510.0**

DISCUSSION:

The application of TWINSPAN and DCA on the vegetation data of the present study led to distinguish four clear separated vegetation clusters. These clusters (*Dichanthium annulatum-Pulicaria crispa, Pluchea dioscoridis, Desmostachya bipinnata-Tamarix nilotica* and *Desmostachya bipinnata-Ziziphus spina-christi*) are comparable, more or less, to those of some related studies in the Nile Delta ruderal habitats (e.g. Shaltout & Sharaf El-Din, 1988; El-Sheikh, 1989, 1996; Shaltout 1994). Some comparable communities were attained by Halwagy (1963) in his study on the vegetation succession in the Nile Islands in Sudan (e.g. Tamaricetum nilotica on moderately fixed silty sand of partly stabilized island and Acacieto-Tamaicetum on oldest stabilized islands). On the other hand, the weed communities of common crops in the Nile Delta are less comparable to the communities of the present study (Shaltout *et al.*, 1992)

The general trend of the vegetation structure in relation to the disturbance levels of the secondary succession in the study area may be as follows; the herbaceous group dominated by *Dichanthium annulatum-Pulicaria crispa* occupies the highly degraded soil of highly disturbed stands, followed by *Pluchea dioscorides* cluster on sites of the medium disturbance. The wood-grassy groups of *Desmostachya bipinnata-Tamarix nilotica* and *Desmostachya bipinnata-Ziziphus spina-christi* dominate in low disturbed sites. This may be related to the uneven disturbance in the area of the present study (e.g. clear cutting, trampling, solid refuses from building operations, ploughing, digging, cultivation) which creates a variety of microsites and communities of different age and variety. The varied microsites may provide conditions favorable to a wide range of species. Also, these anthropogenic influences cause significant changes in structure and dynamics of plant communities; this is reflected today in the presence of numerous types of secondary succession, and plays an important role in the establishment of general pattern of vegetation development (Pickett &White, 1985; Redzic, 2000).

The *Dichanthium annulatum-Pulicaria crispa* cluster has high number of herbaceous plants and species diversity. It inhabits sites of wet soil with highest values of salinity, silt, organic matter and minerals. Most of these sites are affected by highly degraded anthropogenic factors, (e.g. building operations, ploughing, cutting, cultivation and digging). Therefore, under these conditions annual and perennial herbs may develop. The annual weedy species of this community have high reproductive capacity and ecological, morphological, genetic plasticity: a product of relatively rapid evolution under stress of high level of disturbance effects. This cluster is characterized also by anemochore light seeds with papus (has the highest values of pogonochore, sporochore., microsclerochore and desmosclerochores) and can succeed in expansion over large areas. Similar conclusions were reported by many authors (e.g. Frenkel, 1970; Harper, 1977; Grime, 1979; Naveh & Whittaker, 1979; Denslow, 1980; Elias, 1984; Bornkamm, 1986; Lee & Kim, 1995a; Redzic, 2000; Ulanova, 2000; Brakenhielm, 2000; Collins *et al.* 2001; Lee, 2002). *Pluchea dioscorides* cluster also has relatively high values of species number and cover. Brakenhielm (2000) and Lee & Kim (1995*a*) reported high species number in mid-successional stage. They are relatively more stable than the annual weeds

in cluster (A). Duration of the communities in some sites depends on the influence of anthropogenic factors. The exclusion of these anthropogenic influences causes rapid replacement by woody-grassy communities (see Elias, 1984).

The wood-grassy communities of *Desmostachya bipinnata-Tamarix nilotica* cluster (C) and *Desmostachya bipinnata-Ziziphus spina-christi* (D) are associated with soils with the lowest values of salinity, organic matter, and minerals, and finer texture. This can be explained by the rapid development of herbaceous communities showing the vigorous nutrient uptake by weeds from the top soil and much leaching from soil layer caused by insufficient retention of nutrient (Odum, 1960; Aweto, 1981; Odum *et al.*, 1984; Lee, 2002). Therefore the nutrient amounts of soil in abandoned field succession after shifting cultivation in Assuit was smaller in low disturbed patches of the dry land in the study area (Hejny & Kosinova, 1977; Shaltout, 1994). This low disturbance level allows a layer of woody plants to develop and colonize, and appear to be quite stable. *Desmostachya bipinnata-Tamarix nilotica* community was characterized by the highest values of shrubs and the lowest of total cover. Woody plants were co-dominant with grassy species after l5 years of abandonment (Lee, 2002).

***Desmostachya bipinnata-Ziziphus spina-christi* community had low species diversity, species turnover but had the highest percentage of tree/perennial ratio and concentration of dominance. This cluster may represent the dry and low disturbed sites. Results of some related studies show the same conclusion after 25 year of abandonment (e.g. Margalef, 1968; Bazzaz, 1975; Elias, 1984; Bornkamm, 1986; Brakenhielm, 2000; Redzic, 2000; Lee, 2002). Furthermore, the dominance of species such as *Desmostachya bipinnata* and *Ziziphus spina-christi* had a great effect on the ecosystem function. High percentage of trees with long roots often reduces the ground water supplies with serious effect on growth of other species (El-Ghonemy, 1971; Goldsmith & Smart, 1982; Tilman & Dowing, 1994; Shaltout, 1994). The annuals decreased but perennial and woody species increased during abandoned field succession, this shifting pattern of life forms during succession was noted in other countries (Bazzaz, 1968; Osboronova *et al.*, 1990; Lee, 2002). Also as vegetation develops, that is, species turn-over rate tended to slow down, many authors reached to the same conclusion such as Houssard *et al,* (1980), Lee & Kim (1995a) and Lee (2002).**

Some species recorded in the campus (e.g. *Atriplex halimus, Heliotropium supinum, Tribulus terrestris* and *Retama raetam*) represent a desert sandy habitat. Their presence may be associated with the transport of building materials from the adjacent desert (e.g. sand) and/or the deterioration of soil fertility, (see Shaltout, 1994). In addition the study area is opened up and species from the soil seed bank and the adjacent open landscape are given opportunity to germinate and colonize (Chancellor, 1985; Brakenhielm, 2000; Jacquemyn *et al*., 2001). This may explain that species richness, species turnover and cover of species in the present study were higher inside than outside of the campus.

Size differences in plant populations may be caused directly or through differences in growth rates due to age difference, genetic variation, heterogeneity of resources and competition (Weiner, 1985). In the present study, *Ricinus communis* population has a reverse J-shaped curve size frequency distribution. These may represent rapidly growing populations with high reproductive capacity. Such distributions

may indicate a high juvenile mortality as well (Harper, 1977), but they nevertheless seem to represent long-term stability, since in most stable populations one would expect an excess of juvenile over mature individuals (Crisp & Lange, 1976; Goldberg & Turner, 1986; Shaltout & Ayyad, 1988). On the other hand, *Pluchea dioscoridis* and *Tamarix nilotica* have negatively skewed size distributions towards the mature than juvenile individuals. This may indicate that recruitment of individuals is rare in these sites, which may be related to its aridity, low soil fertility, organic matter and competition. These factors have adverse effect on establishment of shrubs and trees (Barbour, 1969; Goldsmith & Smart, 1982; Pickett & White, 1985). The bell-shaped of *Pulicaria crispa* indicates comparable representation of the juvenile and mature individuals. If the current situation continues, a reduction in the population size of this species is expected in the future (Shaltout & Mady, 1993).

The height/ diameter ratio gives an idea about the growth habit of the plant. In the present study, this ratio is more than unity for most species which mean that the individual height exceeds, in average, its diameter and hence individuals of these species tend to expand vertically rather than horizontally. This may be a strategy of the ruderal woody species, which tend to grow in cluster pattern.

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التعاقب النباتى على الارض المهملة فى أسيوط ، مصر

محمد عبد الرءوف الشيخ

قسم النبات – كلية العلوم – جامعة الأزهر (فرع أسيوط)

تمت دراسة وتقيم التعاقب الثانوى للمجمعات النباتية فى الاراضى المهملة داخل الحرم الجامعى لجامعة الأزهر بأسيوط، والذى أنشأ من حوالى ٢٥ عاماً، ومن ثم تم تقييم التدرج فى العلاقات بين العوامل البيئية والتركيب الفلورى ووفرة الأنواع ومستويات التدهور (التخريب) بواسطة الإنسان، وكذا قياس أحجام النباتات الخشبية. وتم تسجيل ٧٨ نوعاً نباتياً منهم ٤٦ نوعاً نباتى حولى، وكذلك ٣٢ نوعاً نباتى معمر. كما تم تعريف أربع مجموعات نباتية بعد تطبيق برامج التقسيم والتنسيق، وبرنامج كانوكوكو CCA ، وعرفت على أساس النبات السائد لكل مجموعة كالآتى :

١- مجموعة الحميرة- بلوكاريا   ٢- مجموعة البرنوف.

٣- مجموعة الحلفا - الاثل   ٤- مجموعة الحلفا - النبق.

وقد لوحظ أن العوامل البيئية التى لها دور فى توزيع هذه المجموعات هى المحتوى الارضى من الرطوبة، مستويات التدهور للمواقع، وكذا نسبة الطمى والطين وكذلك البوتاسيوم .