

Supplementary Materials

Wild plant habitat characterization in the last two decades at the Nile delta coastal region of Egypt

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Table S1. Coordinates and description of sampling sites along River Nile Damietta branch, Dakahlia Governorate.

Location name	Sites	Coordinate system		Different activities nearby sampling locations from LU/LC analysis
		E	N	
Gamasa City (n=4)	1	31°32'22.00"	31°25'27.10"	Residential areas (Gamasa city).
	2	31°32'13.30"	31°25'30.81"	Agricultural land and wild plant habitats.
	3	31°31'53.52"	31°25'38.80"	Industrial area.
	4	31°30'37.00"	31°26'9.80"	Residential area (central security and petrol station).
Delta University zone (n=7)	5	31°30'7.20"	31°26'16.43"	Industrial area (Gamasa industrial district).
	6	31°29'19.00"	31°26'29.88"	Residential area (15-may city).
	7	31°28'36.14"	31°26'58.78"	Uninhabited area (500 m from the main road).
	8	31°27'59.26"	31°27'13.14"	Residential area (areas under construction).
	9	31°27'48.78"	31°27'15.64"	Sand dunes.
	10	31°29'18.73"	31°26'30.26"	Sand dunes.
	11	31°27'48.78"	31°27'20.89"	Area under construction (new Mansoura city).
New Mansoura University (n=1).	12	31°27'11.99"	31°27'38.37"	Uninhabited area (75 m from the main road).
New Mansoura construction site (n=11)	13	31°25'58.68"	31°28'17.30"	Under construction site.
	14	31°24'50.44"	31°28'52.74"	Under construction site.
	15	31°24'23.86"	31°29'5.49"	Salt Marshes.
	16	31°24'20.80"	31°29'7.00"	Sand dunes.
	17	31°24'16.72"	31°29'10.00"	Under construction site.
	18	31°24'15.80"	31°29'11.97"	Uninhabited areas (300 m from main road)
	19	31°23'56.34"	31°29'22.59"	Uninhabited area
	20	31°23'59.85"	31°29'23.66"	Uninhabited area
	21	31°23'54.41"	31°29'28.00"	Uninhabited area (600 m from the main road)
	22	31°23'49.90"	31°29'29.70"	Uninhabited area (400 m from the main road)
	23	31°23'48.46"	31°29'25.30"	Uninhabited area.
Second clover leaf road intersection on the international coastal road (Gamasa - Kafr El-Sheikh) (n=14)	24	31°23'10.10"	31°29'43.18"	Sand dunes
	25	31°23'9.28"	31°29'44.99"	Sand dunes
	26	31°23'8.94"	31°29'47.52"	Uninhabited sand dunes
	27	31°23'0.29"	31°29'49.00"	Sand dunes
	28	31°22'54.87"	31°29'55.87"	Sand dunes
	29	31°22'51.18"	31°30'3.41"	Sand dunes
	30	31°22'31.08"	31°30'25.87"	Sand dunes
	31	31°21'51.94"	31°30'49.06"	Sand dunes
	32	31°21'23.15"	31°30'48.77"	Salt marshes.
	33	31°21'37.19"	31°31'5.40"	Salt marshes
	34	31°20'39.27"	31°31'18.18"	Sand dunes (600m from the main road)
	35	31°19'54.90"	31°31'50.94"	Sand dunes.
	36	31°18'40.80"	31°32'7.87"	Uninhabited area (700 m from the main road)
	37	31°18'0.40"	31°32'24.09"	Uninhabited area (600 m from the main road)

Table S2. Enumerated list of plant species along Deltaic Mediterranean coast (Dakahlia Governorate), together with their families, growth forms, chorotypes, and presence value (P %). Life forms: Th: Therophytes, G: Geophytes, P: Parasites, H: Hemicryptophytes, Ch: Chamaephytes, He: Helophytes, Nph: Nanophanerophytes; Chorotypes: COSM: Cosmopolitan, PAL: Palaeotropical, ME: Mediterranean, ER-SR: Euro-Siberian, SA-SI: Saharo-Sindian, IR-TR: Irano-Turanina, S-Z: Sudano-Zambezian, AUST: Australian.

Species	Family	Life span	Life form	Chorotype	P%
<i>Acacia saligna</i> (Labill.) H.L.Wendl.	Fabaceae	Per.	Nph	AUST	2.70
<i>Aegilops bicornis</i> (Forssk.) Jaub. & Spach	Poaceae	Ann.	Th	ME+SA-SI	32.43
<i>Aegilops kotschy</i> Boiss.	Poaceae	Ann.	Th	IR-TR+SA-SI	8.11
<i>Anchusa humilis</i> (Desf.) I. M.Johnst.	Boraginaceae	Ann.	Th	ME+SA-SI	2.70
<i>Arthrocnemum macrostachyum</i> (Moric.) K. Koch	Chenopodiaceae	Per.	Ch	ME+SA-SI	27.03
<i>Atractylis carduus</i> (Forssk.) C.Chr.	Asteraceae	Per.	H	ME+SA-SI	29.73
<i>Atriplex halimus</i> L.	Chenopodiaceae	Per.	Nph	ME+SA-SI	2.70
<i>Avena fatua</i> L.	Poaceae	Ann.	Th	PAL	2.70
<i>Bassia indica</i> (Wight) A. J. Scott	Chenopodiaceae	Ann.	Th	S-Z+IR-TR	18.92
<i>Bassia muricata</i> (L.) Asch.	Chenopodiaceae	Ann.	Th	IR-TR+SA-SI	16.22
<i>Brassica tournefortii</i> Gouan	Cruciferae	Ann.	Th	ME+IR-TR+SA-SI	8.11
<i>Bromus diandrus</i> Roth	Poaceae	Ann.	Th	ME	29.73
<i>Cakile maritima</i> Scop.	Brassicaceae	Ann.	Th	ME+ER-SR	24.32
<i>Calligonum polygoides</i> L.	Polygonaceae	Per.	Nph	IR-TR+SA-SI	62.16
<i>Carduus pycnocephalus</i> L.	Asteraceae	Ann.	Th	SA-SI	8.11
<i>Carduus getulus</i> Pomel.	Asteraceae	Ann.	Th	SA-SI	5.41
<i>Carthamus tenuis</i> (Boiss. & Blanche) Bornm.	Asteraceae	Ann.	Th	ME	18.92
<i>Chenopodium murale</i> L.	Chenopodiaceae	Ann.	Th	COSM	16.22
<i>Cistanche phelypaea</i> (L.) Cout.	Orobanchaceae	Per.	P, G	ME+SA-SI	2.70
<i>Cutandia memphitica</i> (Spreng.) Benth.	Poaceae.	Ann.	Th	ME+IR-TR+SA-SI	37.84
<i>Cyperus capitatus</i> Vand.	Cyperaceae	Per.	G	ME	13.51
<i>Echinopus spinosus</i> L.	Asteraceae	Per.	H	ME+SA-SI	37.84
<i>Elymus farctus</i> (Viv.) Runem.ex Melderis.	Poaceae	Per.	G	ME	24.32
<i>Erodium laciniatum</i> (Cav.) Wild.	Geraniaceae	Ann.	Th	ME	27.03
<i>Frankenia hirsuta</i> L.	Frankeniaceae	Per.	H	ME+IR-TR+SA-SI	5.41
<i>Halocnemum strobilaceum</i> (Pall.) M. Bieb	Chenopodiaceae	Per.	Ch	ME+IR-TR+SA-SI	27.03
<i>Ifloga spicata</i> (Forssk.) Sch. Bip.	Asteraceae	Ann.	Th	SA-SI	70.27
<i>Inula crithmoides</i> L.	Asteraceae	Per.	Ch	ME+ER-SR+SA-SI	10.81
<i>Launaea mucronata</i> (Forssk.) Muschl.	Asteraceae	Per.	H	ME+SA-SI	21.62
<i>Limonium pruinosum</i> (L.) Chaz.	Plumbaginaceae	Per.	H	SA-SI	2.70
<i>Lobularia arabica</i> (Boiss.) Muschl.	Brassicaceae	Ann.	Th	ME	2.70
<i>Lolium multiflorum</i> Lam	Poaceae	Ann.	Th	ME+IR-TR+ER-SR	13.51
<i>Lotus halophilus</i> Boiss. & Spruner.	Fabaceae	Ann.	Th	ME+SA-SI	51.35
<i>Lycium schweinfurthii</i> Dammer	Solanaceae	Per.	NPh	ME	2.70
<i>Malva parviflora</i> L.	Malvaceae	Ann.	Th	ME+IR-TR	16.22
<i>Melilotus indicus</i> (L.) All.	Fabaceae	Ann.	Th	ME+IR-TR+SA-SI	8.11
<i>Mesembryanthemum crystallinum</i> L.	Aizoaceae	Ann.	Th	ME+ER-SR	32.43
<i>Mesembryanthemum nodiflorum</i> L.	Aizoaceae	Ann.	Th	ME+ER-SR+SA-SI	37.84
<i>Pancreatum maritimum</i> L.	Amaryllidaceae	Per.	G	ME	2.70

<i>Parapholis incurva</i> (L.) C.E. Hubb	Poaceae	Ann.	Th	ME+IR-TR+ER-SR	13.51
<i>Paronychia arabica</i> (L.) DC.	Caryophyllaceae	Ann.	Th	ME+SA-SI+S-Z	13.51
<i>Phragmites australis</i> (Cav.) Trin .ex Steud	Poaceae	Per.	G, He	COSM	10.81
<i>Poa annua</i> L.	Poaceae	Ann.	Th	COSM	45.95
<i>Reichardia tingitana</i> (L.) Roth	Asteraceae	Ann.	Th	ME+IR-TR	32.43
<i>Rumex pictus</i> Forssk.	Polygonaceae	Ann.	Th	ME+SA-SI	78.38
<i>Senecio glaucus</i> L.	Brassicaceae	Ann.	Th	ME+IR-TR+ER-SR	86.49
<i>Silene succulenta</i> Forssk.	Caryophyllaceae	Per.	H	ME	10.81
<i>Silene vivianii</i> Steud.	Caryophyllaceae	Ann.	Th	SA-SI	43.24
<i>Sisymbrium irio</i> L.	Brassicaceae	Ann.	Th	ME+IR-TR+ER-SR	2.70
<i>Sonchus oleraceus</i> L.	Asteraceae	Ann.	Th	COSM	5.41
<i>Spergularia marina</i> (L.) Griseb.	Caryophyllaceae	Bi.	Th	ME+IR-TR+ER-SR	2.70
<i>Sphenopus divaricatus</i> (Gouan) Rchb.	Poaceae	Ann.	Th	ME+IR-TR+SA-SI	16.22
<i>Stipagrostis lanata</i> (Forssk.) De Winter	Poaceae	Per.	G	SA-SI	16.22
<i>Stipagrostis scoparia</i> (Trin. & Rupr.) De Winter	Poaceae	Per.	G	SA-SI	10.81
<i>Tamarix nilotica</i> (Ehrenb.) Boiss.	Tamaricaceae	Per.	Nph	SA-SI+S-Z	35.14
<i>Urospermum picroides</i> (L.) F.W.Schmidt	Asteraceae	Ann.	Th	ME+IR-TR	2.70
<i>Zygophyllum aegyptium</i> Hosny	Zygophyllaceae	Per.	Ch	ME	32.43

Table S3: Number of species and percentage of various floristic categories of the coastal study area.

No.	Chorotypes	No.	%	Type
1	COSM	4	7.02	World wide
2	PAL	1	1.75	
3	ME+IR-TR+ER-SR	5	8.77	Pluriregional
4	ME+IR-TR+SA-SI	6	10.53	
5	ME+ER-SR+SA-SI	2	3.51	
6	ME+SA-SI+S-Z	1	1.75	
7	ME+IR-TR	3	5.26	Biregional
8	ME+ER-SR	2	3.51	
9	ME+SA-SI	10	17.54	
10	IR-TR+SA-SI	3	5.26	
11	S-Z+IR-TR	1	1.75	
12	SA-SI+S-Z	1	1.75	
13	ME	10	17.54	Monoregional
14	SA-SI	7	12.28	
15	AUST	1	1.75	
Total		57	100	

Table S4. Mean and coefficient variation of the importance value (out of 200) of the obtained 4 vegetation groups in 37 sites along Mediterranean coast (Dakahlia). Species in bold are the dominant plants.

Species	Vegetation groups							
	I		II		III		IV	
	Mean	CV	Mean	CV	Mean	CV	Mean	CV
Size of groups	4		12		16		5	
Total number of species	25		43		41		24	
Species present in 4 groups								
<i>Aegilops bicornis</i> (Forssk.) Jaub. & Spach	0.97	2.00	0.76	3.46	10.34	1.05	4.85	2.24
<i>Bassia muricata</i> (L.) Asch.	1.06	2.00	0.64	2.42	0.39	4.00	3.80	1.40
<i>Calligonum polygoides</i> L.	8.91	2.00	23.14	0.83	38.20	0.55	9.85	2.24
<i>Erodium laciniatum</i> (Cav.) Wild.	4.27	1.17	0.55	3.46	3.44	1.59	9.05	1.08
<i>Ifloga spicata</i> (Forssk.) Sch. Bip.	6.50	1.43	7.83	1.05	18.84	0.63	17.08	1.00
<i>Lotus halophilus</i> Boiss. & Spruner.	4.93	1.17	2.05	2.52	11.96	0.72	11.12	0.92
<i>Mesembryanthemum crystallinum</i> L.	17.23	1.52	6.90	0.94	0.23	4.00	2.28	1.40
<i>Mesembryanthemum nodiflorum</i> L.	1.88	2.00	10.02	0.98	0.88	2.92	4.22	1.44
<i>Poa annua</i> L.	7.86	2.00	11.37	0.81	9.97	1.29	1.59	2.24
<i>Reichardia tingitana</i> (L.) Roth	4.41	0.77	0.42	1.95	0.65	1.90	0.45	2.24
<i>Rumex pictus</i> Forssk.	13.26	1.27	10.51	0.78	11.58	0.59	14.15	0.62
<i>Senecio glaucus</i> L.	8.40	0.96	19.04	0.44	16.94	0.55	13.59	0.64
Species present in 3 groups								
<i>Aegilops kotschy</i> Boiss.	3.99	2.00	0.81	3.46	1.20	4.00	-	-
<i>Arthrocnemum macrostachyum</i> (Moric.) K.Koch	-	-	0.88	2.35	1.85	2.31	32.99	0.49
<i>Atractylis carduus</i> (Forssk.) C.Chr.	-	-	1.89	1.25	2.59	1.67	2.79	2.24
<i>Cakile maritima</i> Scop.	-	-	13.93	1.01	1.51	4.00	10.18	2.24
<i>Carthamus tenuis</i> (Boiss. & Blanche) Bornm.	5.86	0.79	1.86	1.91	0.93	4.00	-	-
<i>Chenopodium murale</i> L.	0.98	2.00	1.19	1.51	0.30	4.00	-	-
<i>Echinopus spinosus</i> L.	25.53	0.79	12.76	0.93	6.66	1.92	-	-
<i>Halocnemum strobilaceum</i> (Pall.) M. Bieb	-	-	0.84	3.46	7.21	1.56	2.78	1.47
<i>Inula crithmoides</i> L.	-	-	1.05	3.46	3.58	2.90	8.09	2.24
<i>Silene vivianii</i> Steud.	-	-	0.26	3.46	2.97	0.77	1.85	1.37
<i>Zygophyllum aegyptium</i> Hosny	-	-	25.42	0.60	1.94	4.00	9.01	2.24
Species present in 2 group								
<i>Bromus diandrus</i> Roth	18.38	0.79	13.63	0.89	-	-	-	-
<i>Carduus pycnocephalus</i> L.	4.99	2.00	-	-	1.36	2.74	-	-
<i>Cutandia memphitica</i> (Spreng.) Benth.			7.72	1.91	10.54	1.53	-	-
<i>Cyperus capitatus</i> Vand.			0.38	3.46	2.80	2.10	-	-
<i>Elymus farctus</i> (Viv.) Runem.ex Melderis.	-	-	1.34	2.75	5.12	1.44	-	-
<i>Launaea mucronata</i> (Forssk.) Muschl.	-	-	0.68	2.04	1.11	1.79	-	-
<i>Lolium multiflorum</i> Lam	-	-	1.51	1.89	1.23	2.85	-	-
<i>Malva parviflora</i> L.	10.62	0.83	2.56	1.87	-	-	-	-
<i>Melilotus indicus</i> (L.) All.	1.32	2.00	0.58	2.40	-	-	-	-
<i>Parapholis incurva</i> (L.) C.E. Hubb	3.19	2.00	2.00	1.57	-	-	-	-
<i>Paronychia arabica</i> (L.) DC.	-	-	0.27	3.46	1.71	2.02	-	-
<i>Phragmites australis</i> (Cav.) Trin .ex Steud	-	-	1.03	2.52	1.71	2.74	-	-
<i>Silene succulenta</i> Forssk.	-	-	-	-	0.44	3.36	1.04	1.37
<i>Sonchus oleraceus</i> L.	-	-	0.34	3.46	1.17	4.00	-	-
<i>Sphenopus divaricatus</i> (Gouan) Rchb.	-	-	-	-	1.05	4.00	30.61	0.49
<i>Stipagrostis lanata</i> (Forssk.) De Winter	-	-	0.87	2.35	1.78	1.89	-	-

<i>Stipagrostis scoparia</i> (Trin. & Rupr.) De Winter	-	-	1.80	2.16	0.90	4.00	-	-
<i>Tamarix nilotica</i> (Ehrenb.) Boiss.	-	-	-	-	11.00	0.88	11.03	1.40
<i>Species present in one group</i>								
<i>Acacia saligna</i> (Labill.) H.L.Wendl.	17.19	2.00	-	-	-	-	-	-
<i>Anchusa humilis</i> (Desf.) I. M.Johnst.	2.85	2.00	-	-	-	-	-	-
<i>Atriplex halimus</i> L.	-	-	1.94	3.46	-	-	-	-
<i>Avena fatua</i> L.	-	-	0.71	3.46	-	-	-	-
<i>Bassia indica</i> (Wight) A . J.Scott	-	-	4.62	1.10	-	-	-	-
<i>Brassica tournefortii</i> Gouan	20.29	0.70	-	-	-	-	-	-
<i>Carduus getulus</i> Pomel.	8.14	1.54	-	-	-	-	-	-
<i>Cistanche phelypaea</i> (L.) Cout.	-	-	0.05	3.46	-	-	-	-
<i>Frankenia hirsuta</i> L.	-	-	-	-	-	-	7.53	1.42
<i>Limonium pruinsum</i> (L.) Chaz.	-	-	-	-	1.12	4.00	-	-
<i>Lobularia arabica</i> (Boiss.) Muschl.	-	-	-	-	0.50	4.00	-	-
<i>Lycium schweinfurthii</i> Dammer	-	-	-	-	2.01	4.00	-	-
<i>Pancreatum maritimum</i> L.	-	-	-	-	0.29	4.00	-	-
<i>Sisymbrium irio</i> L.	-	-	0.61	3.46	-	-	-	-
<i>Urospermum picroides</i> (L.) F.W.Schmidt	-	-	0.54	3.46	-	-	-	-

Table S5. CCA biplot scores for soil variables from different sites (n = 37) of the studied area.

Soil variables	Axis 1	Axis 2	Axis 3
Sand	0.202	0.015	-0.138
Silt	-0.144	-0.052	-0.028
Clay	-0.256	0.058	0.416
Porosity	-0.743	0.227	0.006
WHC	-0.329	0.109	-0.334
CaCO ₃	0.243	-0.248	0.021
OC	-0.242	-0.386	-0.124
pH	-0.388	-0.017	0.299
EC	0.537	0.156	0.31
Cl ⁻	-0.334	-0.178	0.047
SO ₄ ²⁻	-0.229	-0.104	0.004
HCO ₃	0.414	-0.226	-0.099
Na ⁺	0.416	0.355	-0.003
K ⁺	0.477	0.348	-0.004
Ca ²⁺	0.446	0.435	-0.011
Mg ²⁺	0.484	0.293	0.005
SAR	0.096	0.381	0.098
PAR	0.451	0.376	0.029
Eigenvalue	0.29	0.245	0.156
Variance %	13.16	11.12	7.07
Cumulative %	13.16	37.45	68.81