

The morphological features and properties of some soils south west paris oasis, Egypt

M.E.M. Wahdan, M. Niazy. And A. M. A .Zayed.

Soils Water and Environment research Institute, Agricultural Research Center, and Giza, Egypt.

Corresponding author: mostafawahdan58@gmail.com

Abstract

The study area is located south west of Paris Oasis and occupies about 178218 hectare and represented by 29 profiles . The study are which had rock formation belong to Cretaceous Nubian Sandstones, and has four landform units:

1- Sand sheet: These soils cover about 95042 hectares representing 53.33% of the total studied area and are classified according to USDA (2014) to seven taxonomic units Coarse loamy, mixed, hyperthermic. TypicTorriorthents

a- Fine loamy, mixed, hyperthermic. TypicTorriorthents. b- Sandy, mixed, hyperthermic. TypicTorriorthents.

c- Sandy over loamy, mixed, hyperthermic. TypicTorriorthents. d- fine loamy, mixed, hyperthermic. Lithic Torriorthents e - Sandy, mixed, hyperthermic. Lithic Haplogypsids. f- Sandy, siliceous, hyperthermic. Typic Torripsammets,

2- Sabkha: These soils cover about 3701 hectares representing 2.07% of the total studied area and are classified to family level. a- Gypsic Haplosalids, fine clayey, mixed, hyperthermic. b- Typic Haplosalids, sandy, mixed, hyperthermic.

3- Pediplain: The soils under consideration have area of about 63428 hectare and represent 35.60% of the total area. The soils of this unit are classified as follows: a- Sandy, mixed, hyperthermic. Typic Torriorthents. b- Fine, loamy, mixed, hyperthermic. Lithic Torriorthents. c- Coarse loamy, mixed, hyperthermic. Lithic Torriorthents. d- Coarse loamy, mixed, hyperthermic. Typic Torriorthents.

4- Barchan dunes belts.

Soils of dunes occupy about 16047 hectare and represent about 9.00% of total area. They have one taxonomic unit: a- sandy, siliceous, hyperthermic Typic Torripsammets.

- Land suitability evaluation

Values of suitability indices for the current suitability are marginally class (S3) except soils of profiles 3, 5 and 25 which are not suitable (N1), soils of profiles 28 and 29 which are not suitable (N2), and soils of profiles 1, 15, 17, 26 and 27 which are moderately suitable (S2). On the other hand, these soils would be moderately suitable (S2) their potential condition. Soils of profiles 17, 24 and 26 which would be highly suitable (S1), and soils of profiles 2, 3, 4, 5, 6, 7, 9, 12, 18 and 19 which would be Margin (S3). The soils of profiles 28 and 29 are permanently not suitable (N2).

Key words: Sabkha, Pediplain, Barchan dunes belts, Land Form, Land classification, Land evaluation

Introduction

Increment of population and limited land in the Nile River valley and delta put stress on the government to create and establish strategic plans for horizontal expansion in the western Desert for food security. The study area is considered one of the promising areas of horizontal expansion in the western Desert. The reclamation of this area aims at establishing channel system between the south Valley project and Al-Kharga Oasis and developing the areas around Darb El-Araba in roads well (AbdelKawy and Darwish, (2014).

The study area has rock formation belong to Cretaceous Nubian Sandstone according to Atlas of Egypt (1928). The rock land is less high, slopes are less steep, gullies less narrow and there are considerable wind-blown sand accumulations in the gullies and lower parts in general

(FAO/SF:16/UAR,1963). The geological map, which produced by EGSA (1988), reveals to the sand sheets formation cover the eastern part and have the predominant area, followed by Sabaya formation (Desert Rose Beds) and sand dunes are concentrated in the western part, while sabkha deposits cover small parts in the north east of the study area.

The climatological data (Table 1) indicate that the highest temperature value was recorded in August (44.1°C) and the lowest one was recorded in December (24.3°C). The total rainfall was 0.20 mm/year. Relative humidity ranged between 14 and 38%. Averages of evaporation, wind speed and sun shine were 7.76 mm/month, 2.7 m/h and 9.7 h/day, respectively. Generally, the area under consideration is characterized by a hot and dry summer with rare winter rainfall.

Table 1. The climatological data of the study area (EL Kharga oasis meteorological station)

Month	Temperature °C		Relative Humidity(%)	windspeed (n/h)	Sun shine (h/day)	Rain fall (mm)	Evaporation (mm)
	Highest	Lowest					
January	24.6	9.2	37	2.5	8.0	0.1	6.0
February	27.7	10.6	27	2.7	8.5	-	5.4
March	32.9	15	19	3.0	10.0	-	6.0
April	35.9	18	17	3.1	10.4	-	5.4
May	39.4	21.9	15	3.0	10.9	-	8.0
June	42.4	24.5	14	2.4	12.6	-	10.4
July	42.3	24.6	16	2.3	12.1	-	8.7
August	44.1	25.3	17	2.7	10.1	-	9.1
September	40.3	23.7	20	2.5	8.7	-	9.9
October	34.5	19.4	23	2.6	8.4	-	9.9
November	29.5	14.3	36	2.5	8.1	-	7.7
December	24.3	9.7	38	2.7	8.0	0.1	6.6
Average	34.8	18.0	23.3	2.7	9.7	-	7.76
Total	-	-	-	-	-	0.20	-

Egypt Meteorological Authority(2014)

According to **USDA (2014)**, the study area belongs to "Hyperthermic" temperature regime and "Torric" "moisture regime.

The objective of this study is to identify the physiographic units morphological features and properties of soils south west Paris Oasis, Egypt with the aid of remote sensing technique.

Materials and Methods

2.1. Study area:

The area under consideration is located south west of Paris Oasis and west of Darb El-Arabain main road between latitudes $24^{\circ}20'$ and $24^{\circ}40'$ N and longitudes $30^{\circ}00'$ and $30^{\circ}30'$ E Fig. (2) and occupies a total area of 178218 hectares.



Fig 1 :Location map of the studied area

2.2. Physiographic analysis:

The physiographic analysis using visual interpretation was carried with Landsat ETM of the year 2005, bands 4,3,2 as RGB. The visual analysis based

On developing techniques of **Lueder (1959)**, **Vink (1963)**,

Goosen(1967) and **Sabins(1978)**.

2.3. Field work:

Twenty nine soil profiles were chosen to represent the main physiographic units of the studied area .the studied profiles are illustrated in Fig. (2).

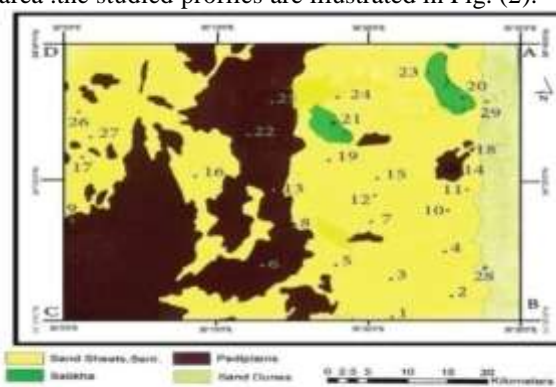


Fig 2 :Physiographic units and locations of representative profiles of the studied area

Soil profiles were dug to bedrock according to **FAO (1994)**.

2.4. Laboratory analysis:

The soil samples were collected, air dried, crushed, sieved through a 2mm sieve and subjected to physical and chemical analyses as follows:

Gravel contents were determined as percentage by volume.

Particle size distribution was carried out using sodium hexametaphosphate as a dispersing agent according to **Black (1965)**.

Soil reaction (pH) was measured in the saturated soil paste (**Richards,1954**).

Soil salinity (ECe) and soluble cations and anions were determined in saturated soil paste extract (**Jackson, 1975**), except soluble sulphate anion which is calculated by subtracting total anions from total cations.

Organic matter contents were determined according to modified procedure in **Jackson(1958)**.

Gypsum contents were determined by precipitation with acetone according to Richards (1954).

Total carbonate contents were measured by Collin's Calcimeter according to **Piper (1950)**.

Soil classification was conducted following up the USDA system (2014).

Land capability classification was done according to Sys and Verheye (1978)

Results and Discussion:

3.1-Physiographic features:

The area under consideration has four landform units according to the visual interpretation of the Landsat satellite image namely, sand sheet, sabkha, pediplain and barchans dunes belts.

A- Sand sheet: Soils of the sand sheet are blanket deposits of sand (**Robert and Julia, 1983**) which are represented by soil profiles 1, 2, 3,4,5,7, 10,11,12,15,16,17,18,19,24,26 and 27. It covers about 95042 hectares representing 53.33% of the total studied area. The main surface features are fine gravel and very few rock outcrops, while thin loose sand sheet cover the unit.

The slope gradient differed between nearly level and sloping.

Soil color through the different layers of the studied profiles ranged between light gray and yellow (Table2).

The very pale brown color is the predominant. Soil depth varied from deep to shallow with textural class varied from sand to clay loam and gravel contents ranging between 5.0 and 40% with few pedogenic features of crystalline gypsum in some profiles. Organic matter content varied from 0.05 to 0.34% (Table3), which represent trace constituents and reflects the arid and thermic conditions. Contents of total carbonate ranged between 0.4 and 8.2%. Gypsum contents range from 0.06 to 5.85%, forming a Gypsic horizon in soil profiles 3 and 12 (Table 3).

Soil chemical characteristics, in Table (4) show that the soil reaction (pH) values ranged from 7.04 to 8.33.

Soil Salinity (ECe) values varied widely between 3.51 and 75.1 dS/m at 25°C of soil paste extract. Generally, soluble contents of anions appeared the following trend $Cl^- > SO_4^{2-} > HCO_3^-$ while soluble cations followed the sequence $Na^+ > Ca^{2+} > Mg^{2+} > K^+$. According to **USDA, (2014)**,

soil profiles of this unit are classified as: Coarse loamy, mixed, hyperthermic, *Typic Torriorthents* in profiles 1, 11 and 16; Fine loamy, mixed, hyperthermic, *Typic Torriorthents* in profiles 4, 15 and 26; Sandy, mixed, hyperthermic, in profiles 10, 17, 18, and 27; Sandy, over loamy, mixed, hyperthermic, *Typic Torriorthents* in profiles 2 and 24; Fine loamy, mixed, hyperthermic, *Lithic Torriorthents* in profiles 5, 7 and 19; Sandy, mixed, hyperthermic, *Lithic Haplogypsis* in profiles 3 and 12.

B-Sabkha:

According to **Robert and Julia (1983)** sabkha in the rock records faces may be indicated by evaporates, absence of fossils, thin flat-pebble conglomerates, stromatolitic laminae, mud cracks, and dolomitization.

Profiles 20, 21 and 23 are the representative profiles of Sabkha unit. It covers about 3701 hectare representing 2.07% of the total studied area.

Data in Fig (2) appear locations of the studied profiles, while, data in Table (2) show the morphological features.

Soils of profile 20 have a thin layer of slightly hard of salt crust, while the others have medium and coarse gravel.

The slope gradient is nearly level. Soil color ranged from 10YR7/2 to 10YR7/8.

Textural classes varied widely from loamy sand to clay. There are some pedogenic features such as crystalline salts with or without gypsum crystals. The Soil depth tended to be moderately deep.

The physical properties illustrated in Table (3) show that organic matter content varied from 0.05 to 0.28%, total carbonate content ranged between 1.5 and 4.5%, gravel contents ranged from 2 to 15%, while gypsum contents differed from 0.89 and 8.54%.

Results revealed the presence of a gypsic horizon through both profiles 20 and 23.

Chemical properties (Table 4) illustrated that pH values ranged between 7.11 and 8.04. Soil salinity (EC) varied widely between 3.1 and 189 dS/m. The distribution of soluble anions followed either the ascending order $SO_4^{2-} > Cl^- > HCO_3^-$ or $Cl^- > SO_4^{2-} > HCO_3^-$, while the distribution of soluble cations followed the ascending order $Na^+ > Ca^{2+} > Mg^{2+} < K^+$.

Soils of all representative profiles of the unit have a salic horizon. According to **USDA, (2014)**, soils of Sabkha unit are classified to the family levels as follows: Fine clayey, mixed, hyperthermic, *Gypsic Haplosalids*, in profiles 20 and 23, and sandy, mixed, hyperthermic, *Typic Haplosalids*, in profile 21.

C-Pediplain.

Pediplain is an extensive thinly alleviated erosion surface formed in a desert region by coalescence of two or more adjacent pediments and occasional desert domes and representing the end result of the mature stage of the arid region cycle, according to **Robert and Julia (1983)**.

The total area of the unit under consideration is about 63468 hectares which represents (35.60%) of total area. Soils profiles 6, 8, 9, 13, 14, 22, and 25 are the representative profiles of pediplain unit. There are few rock outcrops on the surface and slope gradient ranging from gently sloping to sloping (Table 2). Soil color varied between 10YR7/3 and 10YR7/8. The pedogenic features of few soft lime or crystalline gypsum. Are observed. Soils texture classes (Table 3) differed from sand to sandy clay

loam and soil depth varied from shallow to moderately deep. Organic matter content ranged from 0.08 to 0.27%. Gypsum content varied from 0.13 to 3.60%, while lime content ranged between 1.6 and 6.4%, on the other hand gravel contents differed from 2.0 to 50.0%. Soil reaction (pH) ranged between 7.08 and 8.23 (Table 4). EC values varied widely from 2.9 to 101.6 dS/m. Generally, the distribution of soluble anions was: $Cl^- > SO_4^{2-} > HCO_3^-$, and $Na^+ > Ca^{2+} > Mg^{2+} > K^+$ for the soluble cations. According to USDA (2014) the soils of this unit are classified as: Sandy, mixed, hyperthermic, Typic Torriothents, in profiles 6, 8 and 25, Fine loamy, mixed, hyperthermic. Lithic Torriothents, in profiles 9 and 22, coarse loamy, mixed, hyperthermic. Lithic Torriothents, in profile 13 and coarse loamy, mixed hyperthermic. Typic Torriothents, in profile 14;

D-Barchan dunes belts.

Dunes is a sand waves formed on a stream bed, traverse to the direction of flow and traveling downstream of sand from the genetic upstream slope and deposition on the steep downstream slope, (Robert and Julia, 1983). This unit covers about 16047 hectares, which represents 9.00% of total area. This unit was represented by profiles 28 and 29. The Soils have steep sloping, yellow color, sand texture class, singly grains structure, and have not any diagnostic horizons (Table 2). The gravel contents (Table 3) varied between 1.0 and 2.0%, gypsum contents from 0.08 to 0.09%, calcium carbonate

from 0.13 to 0.16%, while organic matter from 0.03 to 0.04%.

Soil reaction (pH) differed from 8.1 to 8.2 (Table 4).

EC ranged between 1.4 and 1.7 dS/m soluble anions followed the sequence of $Cl^- > SO_4^{2-} > HCO_3^-$ while soluble cation follows: $Na^+ > Ca^{2+} > Mg^{2+} > K^+$. According to USDA (2014), the soils of this unit are classified as: siliceous, hyperthermic, *Lithic Torriothents*,

3-2-Land evaluation

According to the parametric of Sys and Verheye (1978) the study soils are evaluated (Table, 5) as follows:

Soils of sand sheet have current suitability varied from not suitable (profile 3 and 5), marginal suitable (profiles 2, 4, 7, 10, 11, 12, 16, 18, 19 and 24) and moderately suitable (profiles 1, 15, 17, 26 and 27). The abundance limitations are soil depth, texture and salinity and alkalinity. The potential suitability would be highly suitable (S1) for profile 17, 24 and 26; moderately suitable (S2) for profiles 1, 10, 11, 15, 16 and 27 and marginally suitable for profiles 2, 3, 4, 5, 7, 12, 18 and 19. The current suitability for the pediplain unit is marginally suitable (S3) except profile 25 which is not suitable (N1). That the soils of this unit Potential would be moderately suitable (S2) except profiles 6, 9, 22 and 25 which would be marginally suitable (S3).

Soils of sabkha are marginally (S3) and moderately (S2) suitable in their current and potential conditions respectively.

Soils of sand dunes appear not suitable (N2) in both current and potential suitability.

Table 2. Morphological description of the studied soil profiles

Phisiographic unit	Profile No.	Depth (cm)	Surface feature	Slope gradint	Depth (cm)	Soil color	Textu- re	Structure	Consistency			
									Dry	wet	Effervesc- enc	lower boun- dary. Pedo- genic featu- re
Sadsheet	1	FfiG	NL	0-30	10YR7/3	L	Ma	H	Sp-S	+	Gw	-
				30-80	10YR7/3	SL	Ma	Sf	Sp-S	+	Gw	-
				80-120	10YR7/4	ScL	Ma	H	Sp-S	+	-	-
	2	FfiG	NL	0-20	10YR7/4	SL	Ma	Sf	Sp-SS	+	Gw	-
				20-60	10YR7/4	LS	Ma	Sf	Sp-SS	++	AS	-
				60-100	10YR7/3	L	Ma	H	p-S	+	-	-
	3	CMfiG	NL	0-15	10YR7/4	S	Sg	L	NP-NS	+	GS	Crystals
				15-30	10YR7/4	LS	Ma	Sf	Np-NS	++	GS	fewgepsum
				30-50	10YR7/6	LS	Ma	Sf	Np-NS	+	-	-
	4	VFRC	G	0-40	10YR7//6	SL	Ma	Sf	Np-NS	++	Gw	Few softCaCo3
				40-75	10YR7/6	SL	Ma	Sf	Sp-SS	+++	-	-
	5	VFR C	GS	0-10	10YR7/6	SL	Ma	Sf	Sp-SS	++	Gw	-
				0-25	10YR7/4	LS	Ma	Sf	Sp-S	+	Abs	-
				25-40	10YR7/3	SCL	WMb	H	P-S	+	-	-
	7	VFR C	NL	0-15	10YR7/3	SCL	WMb	H	P-S	+	Gw	-
				15-30	10YR7/3	SCL	Ma	H	P-S	+	-	-
10	CM &fi G	VGS	0-20	10YR7/4	SL	Ma	Sf	Sp-SS	+++	Gs	-	
			20-45	10YR7/4	LS	Ma	Sf	Sp-SS	++	Gs	Few soft CaCO3	
			45-80	10YR7/4	LS	Ma	Sf	SP-SS	++	Gs	-	
			80-120	10YR7/8	S	Sg	L	Np-NS	++	-	-	
11				0-20	10YR7/6	SL	Ma	Sf	Sp-SS	++	Gw	Fewsoft CaCO3and

Table 2. Cont.

Physi-Ographic unit	Profile No.	Surface Feature	Slope Gradient	Depth (cm)	Soil Color	Texture	Structure	Consistency		Effervescence	Lower boundary	Pedogenic Feature
								Dry	Wet			
Sandsheet		CM&fiG	NL	20-45	10YR7/4	SL	Ma	Sf	Sp-SS	++	Gs	Few gypsum crystals
				45-70	10YR7/6	SL	Ma	Sf	Sp-SS	++	Gw	
				70-90	10YR7/3	SCL	Ma	H	p-S	++	-	
	12	CM&fi G	NL	0-15	10YR7/3	SCL	WMb	H	P-S	+++	Gw	Few CaCO ₃ Nodules and few gypsum crystals
				15-30	10YR7/8	S	Sg	L	Np-NS	++	-	
	15	VffiG	VGS	0-30	10yr7/3	SCL	Ma	H	p-S	+	Gw	-
				30-70	10YR7/6	SL	Ma	Sh	Sp-SS	++	Gw	
				70-110	10YR7/4	LS	Ma	Sf	Sp-SS	+	-	
	16	FfiG	GS	0-30	10YR7/4	LS	Ma	Sf	Sp-SS	++	GS	-
				30-50	10YR7/6	SL	Ma	Sh	Sp-SS	+	Gw	
				50-70	10YR7/6	SL	Ma	Sh	Sp-SS	+	-	
	17	FfiG	GS	0-20	10YR7/4	SCL	Ma	H	P-S	+++	Cw	Few soft CaCO ₃ and few gypsum crystals
				20-60	10YR7/6	LS	Ma	Sf	Sp-SS	+	GS	
				60-90	10YR7/6	SL	Ma	Sf	Sp-SS	+	-	
	18	FfiG	S	0-20	10YR7/6	SL	Ma	Sf	Sp-SS	+	Cw	-
				20-60	10YR7/4	LS	Ma	Sf	Np-NS	+	-	
	19	FfiG	GS	0-20	10YR7/6	SL	Ma	Sh	Sp-SS	++	GW	Few gypsum crystals
				20-40	10YR7/6	SL	Ma	Sh	SP-SS	++	-	
	24	FRC	NL	0-30	10YR7/8	S	Sg	L	Np-NS	++	AS	-
				30-80	10YR7/3	CL	WMb	H	p-S	+	Gw	
80-100				10YR7/4	CL	WMb	H	p-S	+	-		
26	FRC	S	0-20	10YR7/3	SCL	Ma	H	Sp-S	++	GW	Few soft CaCO ₃	
			20-80	10YR7/3	L	Ma	H	Sp-S	++	-		
27	FRC	GS	0-30	10YR7/4	LS	Ma	Sf	Sp-SS	+	GS	-	
			30-80	10YR7/6	S	Sg	L	NPNS	+	Gw		
			80-130	10YR7/6	S	Sg	L	Np-NS	+	-		
Sabkha	20	SC	NL	0-20	10YR7/3	CL	WMb	H	P-S	+	CW	Few Gypsum

Table 2 Cont.

Physiographic unit	Pro- file No.	Surfa- Ce Featu- re	Slope Gradient	Depth (cm)	SoilColor	Tex- ture	Stric- ture	Consistency		Effer- Vesc- ence	Lower boundary	Pedogenic Feature
								Dry	Wet			
Sand sheet	20			20-40	10YR7/3	SC	WMb	H	P- S	+	Gw	Crystals
				40-70	10YR7/2	C	WMb	H	P-S	+	-	
	21	FfiG	L	0-20	10YR7/8	S	Sg	L	Np--NS	++	GW	-
				20-50	10YR7/4	LS	Ma	Sf	Sp-SS	++	GW	-
				50-70	10YR7/6	LS	Ma	Sf	Sp-SS	+	GS	-
				70-90	10YR7/3	SL	Ma	Sf	Sp-SS	+	-	-
	23	CM	NL	0-10	10YR7/6	SL	Ma	Sf	Sp-SS	+	CW	Few Gypsum Crystals and Few CaCO ₃
				10-25	10YR7/2	SC	WMb	H	P-S	+	GW	
				25—50	10YR7/4	SC	WMb	H	P-S	++	-	
	6	CM	NL	0-20	10YR7/4	SL	Ma	Sf	SP-SS	++	AS	FewCaCO ₃ Nodules
20-100				10YR7/8	S	Sg	L	Np-NS	++	-		
8	FRC	S	0-15	10YR7/6	SL	S	Sh	SP-SS	++	GW	Few CaCO ₃ nodules and few gypsum crystals	
			15-30	10YR7/6	SL	Ma	Sh	SP-SS	++	CW		
			30-40	10YR7/6	LS	Sg	L	Np-NS	++	-		
9	FRC	S	0-40	10YR7/38	SCL	Ma	H	P-S	++	-	Few SoftCaCO ₃ -	
13	FRC	GS	0-15	10YR7/6	SL	Ma	Sf	Sp-SS	+	Gw	-	
			15-30	10YR7/3	SCL	WMb	H	p-S	+	Gw		
			30-50	10YR7/6	SL	Ma	Sf	Sp-SS	+	-		
14	FRC	GS	0-15	10YR7/3	SCL	WMb	H	p-S	++	CW	Few CaCO ₃ nod- ules and few gypsum crystals	
			15-60	10YR7/6	SL	Ma	Sh	SP-SS	++	-		
22	FRC	S	0-15	10YR7/4	LS	Ma	Sf	Sp-S S	++	Gw	-	
			15-30	10YR7/6	SL	Ma	Sh	Sp-SS	+	CS		
			30-40	10YR7/3	SCL	Ma	H	p-S	+	-		
25	FRC	GS	0-35	10YR7/4	LS	Ma	Sf	Sp- SS	++	CS	Few CaCO ₃ nodules	
			35-70	10YR7/8	S	Sg	L	NP-NS	++	-		
28	FRC	SS	0-100	10YR7/8	S	Sg	L	Np-NS	+	-	-	
29	FRC	SS	0-100	10YR7/8	S	Sg	L	Np-NS	+	-	-	

-Surface Features: FRC: Few Rock outcrop ,SC:salt crust. **Grade:**F:few, C: common, **Kind:** G:gravel **Size:** fi: fine. Co: coarse, M: medium, VF: very few **-Slope gradient:** L: level, NL: nearly level, S: sloping, GS: gently sloping, SS: strongly sloping, VGS: very gently sloping **-Texture:** L: loam, SCL: sandy clay loam, LS: loamy sand, SL: sandy loam, CL: clay loam, S: sand, C: clay, SC: sandy clay **-Structure:** Ma: Massive; Sg: Single grain; WMb; Weak medium blocky **-Consistence:** **Dry;** Sf. Soft. H: hard. .L: loose, Sh. Slightly hard. Vh. Very hard **Wet:** Plasticity .P, Plastic, Sp. Slightly plastic Np: Nonplastic. VP, Very plastic. Stickness, S, sticky. SS. slightly sticky. NS. non sticky. VS, very sticky **Effervescence:** + slight ++ moderate +++ strong **-Boundary:** As.: Abrupt Smooth .GW: Gradual Wavy. GS : Gradual smooth. AW: Abrupt Wavy .CW : Clear Wavy.

Table 3. Some physical properties of the studied area

Physiographic unit	Profile.No	Depth(cm)	Particlesizedistribution(%)				Textural Class	Organic matter(%)	Gypsum(%)	CaCO3(%)	Gravel(%)
			Coarse Sand (%)	Fine Sand (%)	Slit (%)	Clay (%)					
sandsheet	1	0-30	28.76	16.98	34.02	20.24	L	0.16	0.44	0.40	5.00
		30-80	23.35	21.65	39.42	15.58	SL	0.22	0.30	3.50	5.00
		80-120	38.16	21.11	16.44	24.29	SC L	0.07	0.22	2.40	20.00
	2	0-20	42.55	37.70	6.72	13.03	SL	0.07	0.86	4.7	30.00
		20-60	50.68	36.03	7.09	6.20	LS	0.09	0.71	2.5	10.00
		60-100	12.36	26.50	33.54	27.60	L	0.24	0.29	3.2	10.00
	3	0-15	34.69	54.14	6.57	4.60	S	0.12	5.85	3.50	5.00
		15-30	37.80	42.96	5.38	13.86	LS	0.25	5.40	4.00	5.00
		30-50	30.50	48.39	13.92	7.19	LS	0.18	2.91	1.80	10.00
	4	0-40	36.42	34.35	13.87	15.36	SL	0.06	0.97	6.50	10.00
		40-75	30.83	30.83	7.32	18.08	SL	0.15	0.37	8.20	15.00
		0-10	33.73	23.16	25.63	17.48	SL	0.09	0.86	4.00	5.00
	5	10-20	52.66	25.38	9.51	12.93	LS	0.13	0.49	3.50	10.00
		20-40	43.60	27.19	8.54	20.67	SCL	0.17	0.55	1.80	20.00
		0-15	20.26	28.35	19.40	31.99	SCL	0.25	0.34	1.80	10.00
	7	15-30	18.02	39.69	22.03	20.26	SCL	0.20	0.42	2.00	10.00
		0-20	32.03	40.92	10.38	16.67	SL	0.14	1.94	8.00	2.00
	10	20-45	30.93	51.65	7.59	9.83	LS	0.17	1.66	6.20	2.00
		45-80	46.53	34.96	6.84	11.67	LS	0.12	1.40	4.80	10.00
80-120		49.82	38.45	4.56	7.17	S	0.07	0.14	4.00	15.00	

Table(3)Cont

Profile No	Pro N	Particle size distribution (%)									
		Depth (cm)	Carse sand	Fine sand	Silt	Clay	Texture	OM(%)	Gypsum (%)	CaCO3(%)	Gravel%
11		0-20	40.87	21.92	17.95	19.26	SL	0.12	2.85	5.20	3.00
		20-45	46.08	31.46	7.54	14.92	SL	0.18	2.66	5.60	5.00
		45-70	44.21	27.41	12.04	16.34	SL	0.15	1.60	5.00	10.00
		70-90	42.33	24.00	9.68	23.99	SCL	0.09	1.54	6.40	15.00
12		0-15	29.58	15.42	22.98	32.02	SCL	0.26	5.20	8.00	5.00
		15-30	51.91	38.94	3.26	5.89	S	0.18	5.60	5.20	20.00
		0-30	18.26	39.30	22.19	20.25	SCL	0.08	0.25	2.40	5.00
15		30-70	15.99	43.36	21.91	18.74	SL	0.25	0.29	4.5	20.00
		70-110	40.35	42.84	4.06	12.75	LS	0.16	0.82	1.60	40.00
16		0-30	24.14	56.04	6.88	12.94	LS	0.08	0.06	4.80	2.00
		30-50	15.23	36.05	32.41	15.77	SL	0.16	1.63	3.00	5.00
		50-70	37.84	30.86	22.74	8.56	SL	0.11	1.37	2.40	7.00
17		0-20	40.15	27.48	9.81	22.56	SCL	0.09	1.57	8.00	5.00
		20-60	56.45	26.08	4.53	12.94	LS	0.24	3.95	2.40	20.00
		60-90	54.68	25.28	5.66	14.38	SL	0.07	2.70	1.60	20.00
18		0-20	45.37	32.55	11.57	10.51	SL	0.06	2.28	3.20	30.00
		20-60	47.12	29.33	10.79	12.67	LS	0.14	1.31	2.80	10.00
19		0-20	53.67	25.47	4.26	16.60	SL	0.24	2.80	4.00	15.00
		20-40	42.57	32.65	6.30	18.48	SL	0.16	0.26	3.40	10.00
24		0-30	48.72	44.16	3.65	3.47	S	0.17	2.80	4.00	25.00
		30-80	9.97	27.88	31.19	30.98	CL	0.34	2.40	2.40	5.00
		80-100	7.06	21.75	38.35	32.84	CL	0.22	1.72	1.80	5.00
26		0-20	42.27	29.70	7.00	21.03	SCL	0.09	0.75	6.20	5.00
		20-80	12.11	27.00	35.96	24.93	L	0.24	1.52	4.00	10.00

		Table(3)	Cont.								
27	0-30	55.87	30.19	3.62	10.32	LS	0.21	0.37	1.60	5.00	
	30-80	47.46	42.48	2.58	7.48	S	0.15	0.30	2.30	7.00	
	80-130	52.68	36.01	4.56	6.75	S	0.09	0.27	1.50	10.00	
Sabkha	20	0-20	10.22	19.66	38.07	32.05	CL	0.15	6.45	1.60	7.00
		20-40	24.25	16.12	17.63	41.44	SC	0.28	8.54	2.00	2.00
		40-70	10.74	12.30	33.20	43.76	C	0.22	6.17	1.50	2.00
	21	0-20	37.53	54.24	3.66	4.57	S	0.07	1.30	4.50	2.00
		20-50	42.88	39.00	6.73	11.39	LS	0.16	0.89	3.20	5.00
		50-70	50.29	35.25	5.97	8.49	LS	0.11	1.00	2.00	15.00
		70-90	44.62	28.68	10.77	15.93	SL	0.05	1.46	1.60	7.00
	23	0-10	32.39	25.08	26.56	15.97	SL`	0.13	5.56	1.50	5.00
		10-25	13.19	31.85	8.73	46.23	SC	0.28	5.86	2.60	2.00
25-50		12.51	44.27	4.14	39.08	SC	0.06	5.50	4.00	2.00	
Pediplain	6	0-20	31.43	47.85	6.29	14.43	SL	0.18	1.93	6.40	50.00
		20-100	45.28	42.26	4.20	8.26	S	0.11	1.85	5.80	20.00
	8	0-20	18.04	57.93	8.58	15.75	SL	0.12	3.25	5.00	5.00
		20-40	20.07	32.03	29.15	18.75	SL	0.26	3.60	5.60	2.00
		40-50	28.25	38.71	20.81	12.23	LS	0.20	2.84	3.90	2.00
	9	0-40	27.26	39.48	12.78	20.48	SCL	0.12	0.62	5.30	7.00
	13	0-15	39.65	33.89	10.08	16.38	SL	0.12	0.26	1.60	5.00
		15-30	40.52	30.68	7.33	21.47	SCL	0.26	0.33	2.00	5.00
		30-50	35.43	38.71	10.64	15.22	SL	0.15	0.37	3.00	15.00
14	0-15	18.36	27.64	24.81	29.19	SCL	0.14	3.49	5.60	30.00	
	15-60	38.69	39.68	5.83	15.80	SL	0.08	1.78	6.20	25.00	
22	0-15	46.24	33.70	6.85	13.21	LS	0.11	0.62	4.30	5.00	
	15-30	45.67	26.79	10.21	17.33	SL	0.27	0.73	1.60	10.00	
	30-40	33.03	25.33	21.43	20.43	SCL	0.20	0.34	2.00	10.00	
25	0-35	39.73	28.58	21.45	10.24	LS	0.14	0.13	6.40	20.00	
	35-70	56.49	34.18	2.54	6.79	S	0.08	0.22	5.30	10.00	
Dune	28	0-100	12.71	77.99	5.18	4.12	S	0.03	0.09	0.13	2.0
	29	0-100	10.16	80.79	5.22	3.83	S	0.04	0.08	0.16	1.0

Table 4. Chemical properties of the studied area

Physiographic unit	Profile No.	Depth (cm)	PH	EC (dS/m)	Soluble Anions (me/l)				Soluble Cations(me/l)				SAR	ESP
					CO ₃ ⁼	HCO ₃ ⁻	Cl ⁻	SO ₄ ⁻²	Ca ⁺²	Mg ⁺²	Na ⁺	K ⁺		
Sand Sheet	1	0-30	8.08	5.15	-	3.00	21.00	30.71	26.60	7.70	20.00	0.40	4.83	5.53
		30-80	8.19	14.70	-	2.00	118.00	59.80	42.60	14.60	121.00	1.60	22.66	24.34
		80-120	8.06	16.10	-	1.50	102.50	73.90	59.20	15.10	110.00	1.60	18.06	20.24
	2	0-20	7.99	14.61	-	3.00	116.00	56.20	65.60	16.70	91.60	1.30	14.29	16.54
		20-60	8.15	14.36	-	2.00	114.00	59.20	57.90	20.10	96.10	1.10	15.50	17.76
		60-100	8.07	8.81	-	1.00	56.00	39.60	26.70	11.10	58.00	0.80	13.33	15.54
	3	0-15	8.11	27.20	-	3.50	180.00	142.90	134.00	56.30	134.00	2.10	13.74	15.97
		15-30	7.41	4.90	-	2.00	21.00	27.95	22.60	8.00	20.00	0.35	5.12	5.92
		30-50	7.32	42-60	-	1.00	270.00	240.20	216.50	56.50	234.00	3.90	20.06	22.07
	4	0-40	8.33	11.91	-	3.00	80.00	69.60	51.30	19.20	81.00	1.10	13.63	15.86
		40-75	8.10	7.46	-	2.50	45.00	34.10	25.80	10.20	45.00	0.60	10.61	12.78
	5	0-10	7.91	34.00	-	3.50	235.20	203.30	194.80	29.10	215.00	3.10	20.32	23.06
		10-25	8.11	37.5	-	2.50	241.00	237.50	200.50	86.10	194.15	0.25	16.22	19.31
		25-40	7.54	40.90	-	1.50	220.80	310.40	246.00	115.20	167.30	4.20	12.45	15.51
	7	0-15	7.63	29.50	-	2.50	225.00	123.40	88.10	29.50	230.00	2.30	29.98	30.05
		15-30	7.54	7.95	-	1.00	52.00	46.45	38.20	10.60	50.00	0.65	10.12	12.02
	10	0-20	7.97	55.00	-	3.50	559.00	97.50	46.20	780.00	540.90	4.90	67.37	49.52
		20-45	8.13	24.58	-	3.00	27.075	38.20	26.61	37.70	245.30	2.30	43.27	38.49
		45-80	7.70	18.70	-	2.00	175.00	55.05	40.30	10.10	180.00	1.60	35.85	34.05
		80-120	7.60	18.30	-	1.00	120.00	102.80	72.10	25.30	125.00	1.40	17.90	20.09
	11	0-20	7.48	28.90	-	3.00	240.00	93.80	69.00	35.90	230.00	1.90	20.77	22.71
		20-45	7.53	32.80	-	2.50	290.60	100.50	78.40	40.50	272.40	2.30	21.77	23.58
		45-70	7.47	63.30	-	2.00	531.60	230.00	200.60	79.00	480.00	5.40	40.61	36.96
		70-90	7.35	25.80	-	1.00	192.70	115.90	85.00	54.90	167.60	1.80	2.04	22.06
12	0-15	8.04	7.00	-	3.50	16.50	56.55	46.10	9.80	20.00	0.65	3.78	5.28	
	15-30	7.62	5.60	-	2.00	19.00	38.80	31.80	6.42	21.00	0.58	4.81	6.62	
15	0-30	8.18	9.7	-	3.00	185.00	138.40	119.10	61.20	144.00	210	22.71	24.35	
	30-70	8.10	3.51	-	2.00	15.00	20.60	15.60	6.20	15.00	0.80	4.54	5.16	

Table 4 Cont.

Pediplain	6	0-20	7.08	9.53	-	3.00	36.00	68.00	43.50	23.40	39.00	1.10	6.74	7.99
		20-100	8.04	5.83	-	1.50	43.00	15.60	12.40	4.20	43.00	0.50	14.93	17.19
	8	0-15	8.23	78.20	-	3.00	130.50	87.90	61.50	36.50	118.30	2.10	16.90	18.34
		15-30	7.68	2.90	-	2.00	16.00	11.90	10.20	4.50	15.00	2.00	7.14	8.48
		30-40	7.60	16.40	-	1.00	67.00	128.80	113.60	20.50	61.00	1.70	7.40	8.87
	9	0-40	7.11	7.01	-	3.00	36.00	35.60	30.80	6.10	37.00	0.70	8.62	10.27
		0-15	7.42	11.25	-	3.00	50.00	82.94	56.13	24.90	54.00	0.91	8.45	10.12
	13	15-30	7.65	18.10	-	2.05	152.50	70.71	61.50	22.00	140.00	1.70	21.63	24.19
		30-50	7.83	13.80	-	1.50	125.00	43.50	35.90	11.20	120.00	2.90	24.74	26.73
		0-15	7.47	11.90	-	3.00	76.00	51.90	41.00	11.90	77.00	1.00	14.98	17.24
	14	15-60	7.95	101.60	-	2.00	638.80	578.40	491.10	109.50	608.50	11.10	35.15	33.59
		0-15	8.08	16.50	-	3.00	155.00	42.00	56.40	17.10	125.30	1.20	20.67	22.62
		15-30	7.85	7.90	-	2.50	60.00	30.24	25.20	9.10	58.00	0.44	14.01	16.25
	22	30-40	7.65	20.30	-	1.50	157.00	123.40	87.10	32.90	160.00	1.90	20.67	22.62
		0-35	8.06	51.30	-	2.00	480.30	180.70	152.80	55.10	450.30	4.80	44.15	39.41
		35-70	7.64	36.10	-	1.50	238.80	227.70	215.80	25.20	223.80	3.20	20.41	23.14
Dune	28	0-100	8.1	1.7	-	0.8	13.2	4.1	3.8	2.2	11.9	0.2	6.87	8.15
	29	0-100	8.2	1.4	-	0.6	11.7	2.8	2.6	1.8	10.5	0.2	7.08	8.41

Table 5. Evaluation of the studied soils according to Sys & Verheye(1978)

Physiographic Units	Prof.No.	Physical character								Salinity & Suitability				Suitability	
		Topography		Wetness		Texture	Depth	CaCO ₃	CaSO ₄	Alkalinity		Index		Class	
		C	P	C	P					C	P	C	P	C	P
SandSheet	1	100	100	100	100	95	90	85	90	80	100	52.33	64.41	S2	S2
	2	100	100	100	100	75	75	95	90	80	100	38.47	48.09	S3	S3
	3	95	100	100	100	75	55	95	100	58	100	21.59	39.19	N1	S3
	4	95	100	100	100	75	75	95	90	85	100	38.84	48.09	S3	S3
	5	95	100	100	100	80	55	95	90	58	100	20.73	37.62	N1	S3
	7	95	100	100	100	80	55	95	90	80	100	28.59	37.62	S3	S3
	10	100	100	100	100	75	90	95	100	58	100	35.33	64.12	S3	S2
	11	100	100	100	100	80	90	95	100	58	100	39.67	68.40	S3	S2
	12	100	100	100	100	80	55	95	90	98	100	36.87	37.62	S3	S3
	15	100	100	100	100	95	90	95	90	90	100	65.79	73.10	S2	S2
	16	100	100	100	100	75	75	95	100	58	100	30.99	53.44	S3	S2
	17	95	100	100	100	95	90	95	100	75	100	57.87	81.22	S2	S1
	18	95	100	100	100	70	75	95	100	75	100	35.54	49.87	S3	S3
	19	100	100	100	100	75	55	95	100	80	100	31.35	39.19	S3	S3
24	100	100	100	100	95	90	95	100	58	100	47.11	81.22	S3	S1	
26	97	100	100	100	95	90	95	100	75	100	59.09	81.22	S2	S1	
27	100	100	100	100	75	100	95	90	85	100	54.51	64.12	S2	S2	
Sabkha	20	95	100	100	100	95	75	95	100	45	100	28.94	67.68	S3	S2
	21	100	100	100	100	75	90	95	100	58	100	37.16	64.12	S3	S2
	23	100	100	100	100	95	75	95	100	45	100	30.46	67.68	S3	S2
Pediplain	6	90	100	100	100	55	90	95	100	85	100	35.97	47.02	S3	S3
	8	90	100	100	100	75	75	95	100	80	100	38.47	53.43	S3	S2
	9	95	100	100	100	95	55	95	90	90	100	38.19	44.67	S3	S3
	13	85	100	100	100	95	75	95	90	80	100	41.42	60.91	S3	S2
	14	85	100	100	100	95	75	95	100	58	100	33.36	67.68	S3	S2
	22	85	100	100	100	95	55	95	90	80	100	30.37	44.067	S3	S3
Dunes	25	95	100	100	100	75	75	95	90	45	100	20.56	48.09	N1	S3
	28	30	30	100	100	30	100	85	90	96	100	1.98	2.07	N2	N2
	29	30	30	100	100	30	100	85	90	96	100	1.98	2.07	N2	N2

C: Current suitability P: Potential suitability S1: Highly suitable75-100 S2: Moderately suitable50-75 S3:Marginallysuitable25-50 N:ot suitable<25

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الملاحم المورفولوجية والخواص الأرضية لبعض الأراضي جنوب غرب واحة باريس – مصر

مصطفى عيسى وهدان – مجدى محمد نياذى – عادل محمد عبدالرحمن زايد
معهد بحوث الأراضي والمياه والبيئة – مركز البحوث الزراعية – مصر

تقع منطقة الدراسة جنوب غرب واحة باريس وتشغل حوالى ١٧٨٢١٨ هكتار وتمثلت بحوالى ٢٩ قطاع ارضى حيث اختبرت ووضع وحللت و تنتمى تكوينات منطقة الدراسة الى الرمل النوبى الكريتاسى، وقد قسمت حسب شكل سطح الأرض الى اربع وحدات Land form

Sand sheet -1

وقد قسمت هذه الأراضي حسب التقسيم الأمريكى الى ٦ وحدات تقسيمية كما يلى :

- Typic Torriorthents, find loamy, mixed, hyperthermic.
- Typic Torriorthents, sandy, mixed, hyperthermic.
- Typic Torriorthents, sandy over loamy, mixed, hyperthermic.
- Lithic Torriorthents, fine loamy, mixed, hyperthermic.
- Lithic Haplogypsis, sandy, mixed, hyperthermic.
- Typic Torripsamments, Sandy, Siliceous, hyperthermic.
- وتغضى مساحة ٩٥٠٤٢ هكتار وتمثل ٣٣ و ٥٣% من المساحة الكلية

2-Sabkha وقد قسمت هذه الأراضي حتى مستوى العائلة الى

- Gypsichaplosalids, fine clayey, mixed, hyperthermic.
- Typic Haplosalids, sandy, mixed, hyperthermic.

وتغضى مساحة ٣٧٣١ هكتار وتمثل ٢٠٧ و ٢% من المساحة الكلية

3-pediplain وقد قسمت اراضى هذه الوحدة كما يلى

- Lithic Torriorthents, fine, loamy, mixed, hyperthermic.
- Typic Torriorthents, sandy, mixed, hyperthermic.
- Lithic Torriorthents, coarse loamy, mixed, yperthermic.
- Typic Torriorthents, coarse loamy, mixed, hyperthermic
- بلغت مساحة هذه الوحدة حوالى ٢٣٩٩٩ و ٥٨ هكتار وتمثل ٦ و ٣٥ من المساحة الكلية

4-Barchan dune belts وهى ذات وحدة تقسيمية واحدة هى

- Typic Torripsamments, sandy siliceous, hyperthermic
- كانت مساحة هذه الوحدة ١٦٠٤٧ هكتار وتمثل حوالى ٩٠ و ٩% من المساحة الكلي

-تقييم الاراضى- اظهرت قيم صلاحية الارض على حالتها ان هذه الارض ذات صلاحية حدية (S3) القطاعات ٣ و ٥ و ٢٥ غير صالحة

(N1) والقطاعات ٢٨ و ٢٩ غير صالحة (N2) بينما القطاعات ١ و ٥ و ١٧ و ٢٦ و ٢٧ ذات صلاحية متوسطة (S2)

من ناحية اخر فان قيم صلاحية الارض بعد تحسين بعض خصائصها قد اظهرت مستوى صلاحية متوسطة (S2) (عدا القطاعات ١٧ و ٢٤ و ٢٦ فقد اظهرت مستوى عالية الصلاحية (S1) والقطاعات ٢ و ٣ و ٤ و ٥ و ٦ و ٧ و ٩ و ١٢ و ١٨ و ١٩ فكانت ذات صلاحية حدية (S3) بينما القطاعات

٢٨ و ٢٩ اظهرت مستوى عديمة الصلاحية (N 2)