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STUDY OF LAND RESOURCES AT SIWA OASIS USING REMOTE SENSING AND GIS TECHNIQUEES

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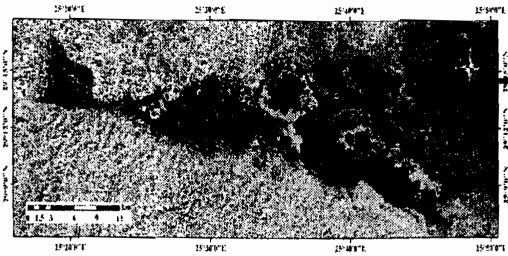
ABSTRACT

The area under investigation bounded by 25° 16' - 26° 7' E and latitudes, 29° 7' - 29° 21' N; and extended for about 70km in east-west direction, with a width of 7-10 km. The dominant texture class varied from sand, loamy sand, sandy loam; and silt loam. pH values ranged between 7.4 and 9.3. CaCo3 content ranged between 1.6 and 42.3%. O M values varied from 0.1 and 2.6%. Gypsum content ranged between 0.01and 5.04%. EC values varied from 0.5 and 98.3 (ds/m). The CEC values varied from 1.9 and 35.09(mq/l). ESP values varied from 6.3 and 36.4%. Nitrogen values varied from 11.1 and 55.9(ppm). Phosphorus values varied from 2.8 and 60.8(ppm). Potassium values varied from 186.6 and 933.1 (ppm). Based on the american soil taxonomy-the soils were classified as Typic Torripsamments, Typic Psammaquents, Typic Haplosalids, Typic Aquisalids, Gypsic Haplosalids, Calcic Aquisalids, Typic Haplocalcids, Lithic Haplocalcids, and Duric Haplosalids. The soil capability varied from Good , Average , Low ,and Extremely low. Soil suitability for alfalfa, green pepper, onion, maize, barley, sugar cane, tomato, wheat, and wheat ranged between marginal and unsuitable except for olives, and date palm, ranged between moderate and unsuitable.

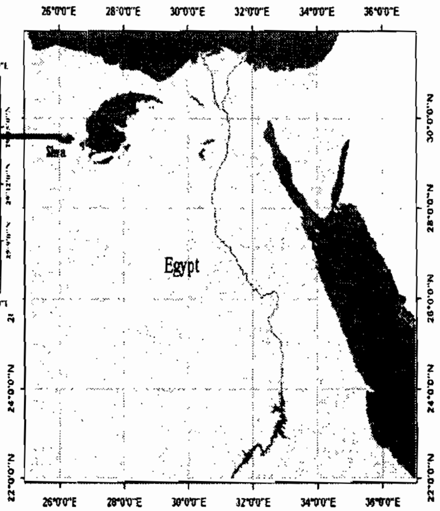
Keywords: Soil capability, soil suitability, soils classified, Nitrogen, phosphorus, potassium.

INTRODUCTION

The Siwa Oasis occupies a large depression west of the western Egyptian desert (Map 1), approximately 300 Km south from the Mediterranean coast in correspondence of the city of Marsa Matruh. The Siwa depression (29° 7'- 29° 21' N e 25° 16' - 26° 7's) roughly stretches from east to west for approximately 82 Km, with a width that varies between 9 and 28 Km, and a total area of about 2,950 km. sq representing the ideal continuation towards west of the larger depression of Qattara (Said, 1990).



Landsat ETM+ of Siwa oasis 2003



Map (1). Location of the study area

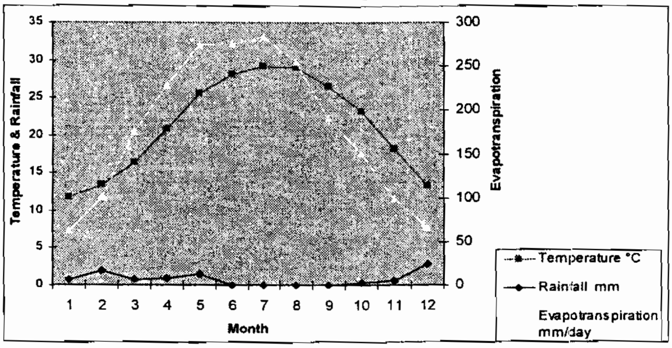


Figure (2) : climatology of studied area (Climatologically Normal for Egypt, 2011).

Abu Al-Izz (1999), and said (2000). The Stratography of the exposed rocks in Siwa depression from oldest to youngest are Middle Eocene, upper Eocene, Oligocene, Miocene, recent and sub-recent deposits. The Miocene deposits form the greater part of Siwa area, cover a large part of the depression floor, the entire northern scarp, and many hills of southern scarp, such as Gabal El-Dakrur. The Miocene section is approximately 120 m thick and divisible into lower unit of clastics and upper unit of solid limestone. The lower unit of clastics is of a wide distribution in the southern limits of the depression and within the depression. It consists of shales, sandstones and marl beds that are rich in fossiliferous; many of the shales are gypsiferous. The upper limestone unit is composed of coarse-grained-limestone beds with some marls. The recent and sub-recent deposits have accumulated along the southern limits of the depression, forming parallel north west-trending sand dunes, and salty soils with crusts on the surface that cover a large part of the depression floor.

According to Abu Al-Izz (1999), the geomorphologic features are very important in Siwa depression, and could be noted as follows: 1- The sea of sand: It occupies an area of about 500 km long by 160 to 180 km wide. The actual composition of this "sea" is waves of Seif dunes separated by wades. 2- The lakes: The most important lakes in Siwa depression are Al-Maraqui lake, Siwa lake, Khamisa lake, Al-Zeitun lake, and Other lakes: there are also great numbers of small lakes such as Al-Maasir, Tamira, Aghormi, each of these lakes has an area not more than hundreds of square meters. 3- The hills and mountains: The main hills are Um Al-Huwaymil, Qar*et al*-Hamra, Qar*et al*-Bayda and Qaret El-Gari. The main mountains are Gabal Siwa (38m), Gabal El-Mawta (42m), Gabal El-Kosha (36m), Gabal Aghormi (16m), Gabal El-Dakrur (88m), Gabal El-Girba (120m), Gabal El-Migahiz (100m), Gabal western Migahiz (120m), and Gabal Umm Hiyus (90m).

Abo-Ragab and Samy (2008), reported that to their studies on Siwa soils organic matter is mostly low owing to the prevailing climatic condition and ranged between 0.03 to 2.83 %. The low cation exchange capacity indicate that Siwa soils are relatively poor in organic matter content, and relatively low clay content, besides their high $CaCO_3$ content. The CEC values of Siwa soils ranged between 4.0 – 25.2 $cmol_c$ /kg soil. Abd El-Samie (2000), reported that in the coarse clay fraction there were Kaolinite with some mixed-layer Montmorillonite - Illite and few quartz, while Smectite was abundant in the fine clay fraction. Omran (2002) defined 18 taxonomic units representing the soil mapping units in Siwa, which are belong to two orders, Entisols and Aridisols. Entisols include Torripsamments and Torriorthents. Aridisols include Haplocambids, Aquisalids, Haplosalids, Aquicambids, and Petrocalcids.

According to Fanous (1979) and Sherif (1979), there are native forage such as common sadge maishshear grass (*Glodium Mariscus Cyperacoae*), Camel thorne (*A.maurorum Leguminosae*) and matsedge (*Juncus Arabicus*) grown in some areas having relatively high water table. Also, native seeding date palms (*Phoenix Dectylifera linn*) are widely spread in Siwa oasis.

Abdel-Mogheeth *et al.* (1995), All aquifers (Miocene limestone ,Eocene limestone and dolomite , lower Cretaceous sandstone) in Siwa oasis are under artesian head and their waters are naturally flowing. The upward leakage from the deeper sandstone aquifer to the shallower carbonate one is still not proved.

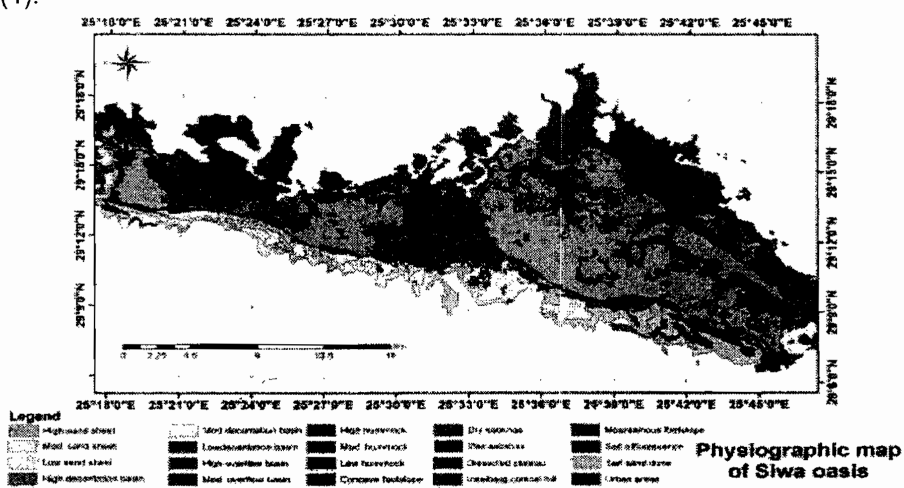
Geographical Information Systems (GIS) have proved to be immensely helpful in the organization of the huge database generated through space technology (Bolstad, 2005). The utility of GIS in the analysis and modeling of integrated information is well established (Buzai and Robinson, 2010). GIS has been used in the development of digital databases, assessment of status and trends of resources utilization of the areas and to support and assess various resource management alternatives (Harvey, 2008). Spectacular developments in the field of GIS to synthesize various thematic information with collateral data have not only made this technology effective and economical but also a tool to arrive at development strategies for sustainable land and water resources management.

Farmers can order spectral imagery of their fields to determine the status of their land and whatever is growing on it. For example, spectral imagery can indicate the amount of fertilization required in specific locations that are designated with GPS coordinates. Agricultural machinery on the market today has the capability to load this information into computers built into the machinery and automatically adjust the amount of fertilizer deposited based on the information contained in the spectral imagery. The type of vegetation can also be determined from spectral remote sensing. (Elangovan, 2006) shows the types of plants growing in a field. Because stressed vegetation looks different from healthy vegetation, mapped remote.

MATRIALS AND METHODS

Physiographic mapping

Physiographic map produced for the study area was carried out using digital image processing of Landsat7 ETM+ image, dated to 2005 (map. 2). This image was executed using ENVI 5.0 software (ITT 2012). Digital elevation model (DEM) of the studied area is used for driven Physiographic mapping units. Satellite image was stretched using linear 2 %, smoothly filtered and their histograms were matched according to Lille sand and Kiefer (2007). The image was atmospherically corrected using; FLAASH module (ITT 2012). The different landforms were initially determined and delimited from the satellite image and the digital elevation model extracted from the contour map, following the methodology developed by Dobos et al. (2002) map (2) and Table (1).

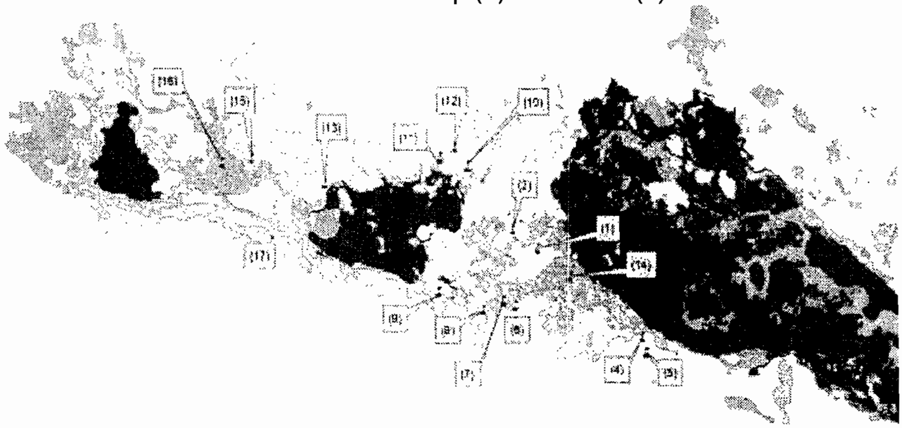


Map (2) Physiographic map of the stuided area.

Table (1): Physiographic map legend of the stuided area .

Physiographic units	Landform	Mapping units	Area (Km^2)	Total area %
Sand sheets (SS)	- High sand sheets	SS1	22.4	4.2
	- Mod. high sand sheets	SS2	17.3	3.3
	- Low sand sheets	SS3	26.2	4.9
			65.9	**12.4**
Hummocks (HA)	- High hummocks	HA1	8.0	1.5
	- Mod. high hummocks	HA2	4.0	0.8
	- Low hummocks	HA3	0.9	0.2
			12.9	**2.5**
Alkali flats (AF)	- Wet sabkhas	AF1	26.8	5.0
	- Dry sabkhas	AF2	75.8	14.3
			102.6	**19.4**
Overflow basins (OB)	- High overflow basins	OB1	13.3	2.5
	- Mod. high overflow basins	OB2	4.9	0.9
	- Low overflow basins	OB3	1.3	0.2
			19.5	**3.6**
Decantation basins (DB)	- High decantation basins	DB1	6.0	1.1
	- Mod. high decantation basins	DB2	7.7	1.5
	- Moderate decantation basins	DB3	8.9	1.7
	- Low decantation basins	DB4	3.9	0.7
			26.5	**5.0**
Mountain footslopes (MF)	- Inclined footslopes	MF	21.6	4.1
Hill footslopes (HF)	- Concave footslopes	HF	73.1	13.8
- Longitudinal sand dunes	- Seif dunes	L	8.7	1.6
-Marmarica plateau	- Dissected plateau	P	21.8	4.1
- Scattered hills	- Inselberg, conical hills	I	0.9	0.2
	- Buttes	B	0.4	0.1
	- Mesas	M	1.1	0.2
- Salt flats.	- Salt flats	E	33.4	6.3
- Lakes, Water bodies	- Lakes, water bodies	W	134.9	25.5
- Urban area		U	6.6	1.2
Total area.			529.9 km^2 (126166.7 feddans)	

Physiographic map unit's representative by 17 soil profiles and 100 soil observation to check unit boundaries map (3) and Table (2).



Map(3) Physiographic map of soil profiles location.

Table (2): soil profiles location(Lat.& Long.**).**

ID	pr.dpth	physiography	Lat.	Long.
1	120	High overflow	29 12 06.91	25 32 43.42
2	100	Mod. Overflow	29 12 36.43	25 31 54.87
3	60	Low overflow bas	29 12 34.97	29 32 47.19
4	150	High hummock	29 09 55.09	25 36 08.85
5	150	High sand sh	29 09 31.40	25 36 15.42
6	100	Mod. hummock	29 10 40.76	25 32 01.15
7	50	Low decantation	29 10 48.42	25 31 37.24
8	60	Low sand sheet	29 10 33.99	25 30 59.24
9	80	Low hummock	29 11 00.63	25 29 31.87
10	150	High decant	29 14 15.72	25 30 24.10
11	50	Wet sabkha	29 14 28.56	25 29 33.91
12	80	Dry sabkhas	29 14 40.63	25 30 00.13
13	100	Mod high decan	29 13 42.12	25 25 49.15
14	150	Mod. sand sh	29 11 26.16	25 33 45.91
15	40	Concave foots	29 14 19.25	25 23 25.25
16	25	Inclined footsl	29 14 11.10	25 22 28.42
17	80	Mod decantation	29 12 11.57	25 24 06.86

Field work:-

Soil profile study:-Detailed morphological description of 17 soil profiles representing the different physiographic map units was recorded on the basis outlined by **FAO** (2010) , and Mensal color charts . A total of 52 disturbed soil samples were collected for determining different soil properties.

Laboratory analyses:-

The collected disturbed soil samples were air–dried; ground gently, then sieved through 2 mm sieve and gravel content were calculated. The soil samples were mechanically analyzed according to the international method using Sodium Hexameter phosphate as a dispersing agent (to calculate texture class). Calcium carbonate, Organic matter, Electric conductivity EC dS/m, Soil reaction (pH) in soil paste, Gypsum content, Caution exchange capacity (CEC), Exchangeable sodium, Available nitrogen, Available phosphorus, Available potassium, were determined according to (Black,1982 and 1986).

Keys to Soil Taxonomy (USDA 1999) were used to classify the different soil profiles according to the morphological description of the investigated profiles and the data extracted. Arc GIS 10.1 utility and its spatial analyst extension (ESRI 2012) were used for soil mapping , land capability and land suitability mapping. Land capability determined according to Require (1970), FAO (1976), El-Toukhy (1995), and Arc GIS 10.1 , Land suitability assessment by ASEL program according to (Ismail *et al.* 1994).

In this research, ASEL-GIS model was used for land assessment and comparison purposes. It stands for the Agriculture Land Evaluation System for arid and semi-arid regions and has been developed by Ismail *et al* (2005). The land suitability indices, classes, and limitations for 13 crops were calculated by matching the standard crop requirements (internal coded data within the model) and various soil parameter levels (FAO 1976; Ismail *et al.* 1994, 2001). Nevertheless, ASEL was linked directly to its relational database and coupled indirectly with a GIS through the loosely coupled strategy. Using land suitability analysis based on GIS utility, site information can be gained. It is considered as strong and efficient application within land use planning, habitat analysis, etc. (El-Nahry and Khashaba 2006).

RESULTS AND DISCUSSION

This current study deals with the current land in order to assess land suitability for main strategic crops.. The presentation and discussions will be grouped under the following headings:

5.1 The main physiographic unites of Siwa oasis.

5.2 Soil mapping and Taxonomy.

5.3 Land capability

5.4 Land suitability classification.

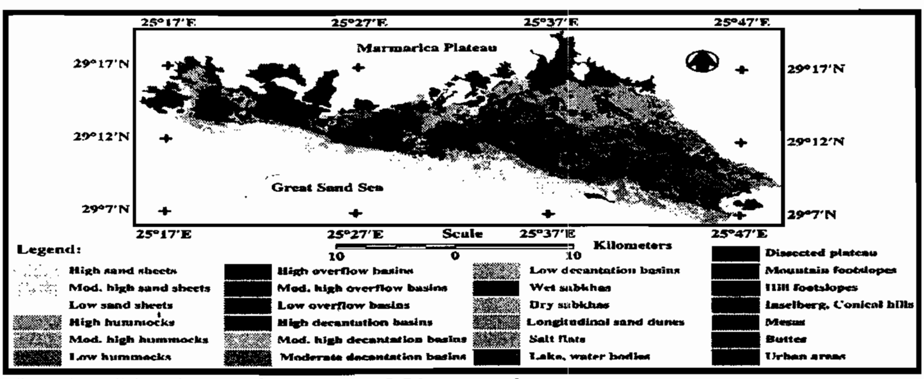
5.1 The main physiographic unites of Siwa oasis.

Physiographic units were identified throughout remote sensing image. The obtained results (table 5 and map 5) include the following Physiographic units:

17 Soil profiles representative the physiographic map units of studied area decrypted and collected the soil samples(52) were done.

Table (3): Physiographic legend and areas of the different mapping units.

Physiographic units	Landform	Mapping units	Area (Km²)	Total area %
Sand sheets (SS)	- High sand sheets - Mod. high sand sheets - Low sand sheets	SS1 SS2 SS3	22.4 17.3 26.2	4.2 3.3 4.9
			65.9	**12.4**
Hummocks (HA)	- High hummocks - Mod. high hummocks - Low hummocks	HA1 HA2 HA3	8.0 4.0 0.9	1.5 0.8 0.2
			12.9	**2.5**
Alkali flats (AF)	- Wet sabkhas - Dry sabkhas	AF1 AF2	26.8 75.8	5.0 14.3
			102.6	**19.4**
Overflow basins (OB)	- High overflow basins - Mod. high overflow basins - Low overflow basins	OB1 OB2 OB3	13.3 4.9 1.3	2.5 0.9 0.2
			19.5	**3.6**
Decantation basins (DB)	- High decantation basins - Mod. high decantation basins - Moderate decantation basins - Low decantation basins	DB1 DB2 DB3 DB4	6.0 7.7 8.9 3.9	1.1 1.5 1.7 0.7
			26.5	**5.0**
Mountain footslopes (MF)	- Inclined footslopes	MF	21.6	4.1
Hill footslopes (HF)	- Concave footslopes	HF	73.1	13.8
- Longitudinal sand dunes -Marmarica plateau - Scattered hills - Salt flats. - Lakes, Water bodies - Urban area	- Seif dunes - Dissected plateau - Inselberg, conical hills - Buttes - Mesas - Salt flats - Lakes, water bodies	L P I B M E W U	8.7 21.8 0.9 0.4 1.1 33.4 134.9 6.6	1.6 4.1 0.2 0.1 0.2 6.3 25.5 1.2
Total area.			529.9 km² (126166.7 feddans)	



Map (4): Physiographic map of Siwa oasis

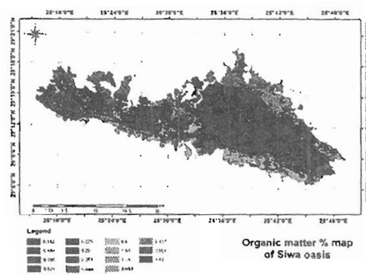
Table (4) Morphological features of the soil profile description .

Profile No.	Long	Lat	Depth in cm	Slope	Color		Texture class	Structure	stickiness	plasticity	consistency	carbonates	Boundary
					Dry	moist							
1	25 32 43.42	29 12 06.91	0-5	Nearly level	DB	B	LS	MSB	SS	SP	SH	ME	DS
			"5-30		DGB	GB	S	SG	NS	NP	L	M-H	DS
			30-80		DYB	YB	LS	WG	SS	SP	SH	M-H	CS
			80-120		GB	LBG	S	SG	NS	NP	L	F-M	
			120+	Water Table									
2	25 31 54.87	29 12 36.43	0-30	Nearly level	DYB	DYB	SL	MFSB	SS	SP	SH	M	CW
			30-60		YB	OB	SL	MFSB	SS	SP	SH	M	CW
			60-90		OB	YB	SL	MMSB	SS	SP	SH	M	CW
			90-100		DYO	DYO	SL	WFSB	SS	SP	SH	M	
			100+	Water Table									
3	29 32 47.19	29 12 34.97	0-30	Nearly level	B	DYB	S	SG	NS	NP	L	M	CW
			30-50		DB	DB	S	SG	NS	NP	L	M	CW
			50-60		BYB	BYB	S	SG	NS	NP	L	M	
			60+	Water Table									
4	25 33 45.91	29 11 26.16	0-35	Nearly level	BYB	BYB	S	SG	NS	NP	L	M	CW
			35-80		DYO	BYB	S	SG	NS	NP	L	M	CW
			80+	Water Table									
5	25 36 08.85	29 09 55.09	0-7	Gently sloping	YB	YB	LS	WVFP	SS	SP	SH	M	CW
			"7-27		BYB	BYB	LS	VWFSB	SS	SP	SH	M	CW
			27-150		YB	YB	SL	WMSB	SS	SP	SH	M	CW
6	25 36 15.42	25 36 15.42	0-15	Nearly level	DY	BYB	S	SG	NS	NP	L	M	DW
			15-150		DYO	LYO	S	SG	NS	NP	L	M	M
7	25 32 01.15	29 10 40.76	0-10	Gently sloping	LYO	DYO	SL	WMG	SS	SP	SH	M	CW
			"10-20		DO	O	LS	WFG	SS	SP	SH	M	CW
			20-60		YB	YB	LS	WFC	SS	SP	SH	M	CW
			60-100		BYB	BYB	S	SG	NS	NP	L	M	
			100+	Water Table									
8	25 31 37.24	29 10 48.42	0-5	Nearly level	BYB	DYO	SL	WFSB	SS	SP	SH	M	ABW
			"5-35		YB	BYB	LS	WMSB	SS	SP	SH	M	CI
			35-45		YB	YB	LS	MMSB	SS	SP	SH	M	GW
			45-50		YB	BYB	LS	WSB	SS	SP	SH	M	S
			50+	Water Table									
9	25 30 59.24	29 10 33.99	0-13	Nearly level	DB	BYB	S	SG	NS	NP	L	M	CS
			13-27		YB	BYB	S	SG	NS	NP	L	M	CS
			27-40		YB	BYB	S	SG	NS	NP	L	M	GS
			40-60		YB	YB	S	SG	NS	NP	L	M	
			60+	Water Table									
10	25 29 31.87	29 11 00.63	0-15	Gently sloping	BYB	BYB	LS	WMFG	SS	SP	SH	W-M	ABW
			15-21		DYO	BYB	S	SG	NS	NP	L	M	CS
			21-80		LYO	DYO	S	SG	NS	NP	L	M	
			80+	Water Table									
11	25 30 24.10	29 14 15.72	0-10	Nearly level	YO	LYO	SL	WMG	SS	SP	SH	S	CR
			"10-40		BYB	BYB	LS	WFSB	SS	SP	SH	S	CW
			40-75		DYO	DYO	L	WMSB	MS	MP	MH	S	CW
			75-150		DYO	DYO	SL	WMSB	SS	SP	SH	S	
			150+	Water Table									
12	25 29 33.91	29 14 28.56	0-12	Nearly level	DYO	DYO	L	MF-MS	VS	VP	VH	VS	CS
			"12-42		BYB	BYB	SIL	MMA-SB	VS	VP	VH	VS	DS
			42-50		DYO	DYB	SIL	MMA-SB	S	P	H	VS	
			50+	Water Table									
13	25 30 00.13	29 14 40.63	0-10	Nearly level	DYO	DYO	S	SG	NS	NP	L	M	ABI
			"10-40		BYB	BYB	S	SG	NS	NP	L	S	GS
			40-80		DYO	DYO	S	SG	NS	NP.	L	M	
			80+	Water Table									
14	25 25 49.15	29 13 42.12	0-5	Nearly level	OY	PY	SIL	MMA-SB	SS	SO	SH	M	DS
			"5-40		BY	VPB	S	SG	NS	NP	L	M	CS
			40-100		LYB	PY	LS	MMA-SB	S	P	H	S	
			100+	Water Table									
15	25 24 06.86	29 12 11.57	0-45	Nearly level	B	YB	S	SG	NS	NP	L	W-M	CW
			45-120		YB	BYB	S	SG	NS	NP	L	W-M	
			100+	Water Table									
16	25 23 25.25	29 14 19.25	0-10	Nearly level	YB	YB	LS	WSB	MS	MP	H	M	ABI
			"10-40		BYB	BYB	S	SG	NS	NP	L	M	
			40+	Limestone duripan									
17	25 22 28.42	29 14 11.10	0-10	Gently sloping	BYB	BYB	S	SG	NS	NP	L	M	AB-I
			"10-25		BY	BYB	S	SG	NS	NP	L	S	
			25+	Limestone duripan									

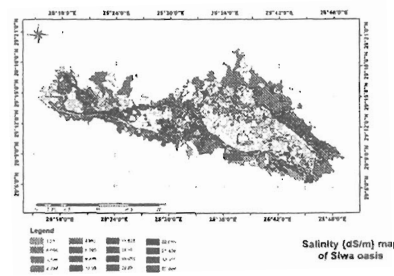
Chemical analysis:- The chemical analysis of the studed area showed in table (4) and maps (5) From table (4) and maps (5) clear that the soil reaction (pH) ranged between 7.4 and 9.3 which could be referred to increased in alkali in some units. $CaCO_3$ content ranged between 10 and 51.4% except soil profiles 6, 9, 10, 14, and 17 were less than 10% which could be referred to the calcareous sediments of parent material. gypsum content were less than one in the dominant profiles excepted soil profiles 5, 10, 11, and12 ranged between 1.59 and 5.04% . O.M% values are less than one except in profiles 2, 3, 5, 6, 11, 12, and 14 are ranged between 1.01 and 2.6% . EC (dS/m) values are ranged between moderate and high as 2.6 and 98.3 which could be referred to the ground water is near from the surface and parent material except soil profiles 3, 4, 5, 6 are low than 2 dS/m. Available values of Nitrogen (ppm) ranged between 5.5 and 22.4 (ppm) which refereed to decrease organic matter. Available of phosphorus values ranged between 2.8 and 20.8 (ppm) which refereed to fixate by parent material. Available values ranged between 186.6 and 606.8 (ppm).

Table(5) The chemical analysis of the investgated area.

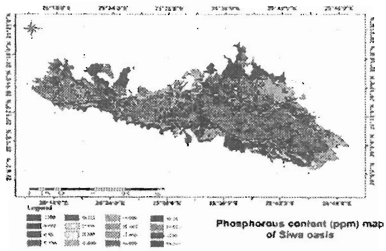
ID	pH	CEC	EC(dS/m)	$CaCO_3$ %	ESP %	Gypsum %	O.M%	N(ppm)	P(ppm)	K(ppm)
1	7.8	13.6	12.1	17.4	13.2	0.049	0.8	11.1	51.8	322.8
2	8.1	26.4	2.8	14.79	6.3	0.006	1.3	13	20.4	376
3	7.9	9.3	1.4	11.9	6.8	0.005	1.1	13.6	60.8	125.4
4	8.3	2.7	0.5	11.44	9.2	0.007	0.1	11.7	11.1	248.7
5	8.8	19	1.6	10.7	15.4	1.59	1.01	5.5	47.3	252
6	8.3	3.3	0.8	9.03	29.7	0.007	2.6	19.5	33	351.5
7	9.3	20.2	66.9	21.7	27.6	0.001	0.29	22.4	6.68	827.3
8	8	14.9	42.8	11.6	11.1	0.003	0.3	8.3	16.4	431.2
9	8.3	4.1	3.03	7.5	8.7	0.002	0.2	14.4	11.5	280.1
10	8.5	5.7	3.04	1.6	26.6	5.043	0.1	12.2	10.1	186.6
11	8.1	21.4	12.9	51.4	36.4	2.088	2.6	13.2	13.6	720.4
12	7.8	35.1	30.3	20.4	34.8	2.93	2.4	19.4	15.3	282.6
13	8.3	4.7	32.3	42.3	23.7	0.845	0.2	8.49	55.9	264.5
14	7.9	30.1	18.6	6.8	17	0.003	2.05	11.7	2.8	606.8
15	8.1	1.9	21.1	25.11	29.3	0.347	0.2	12.7	17.4	933.1
16	8.4	4.9	54.3	40.6	12.3	0.236	0.6	55.9	4.8	531.8
17	7.4	4	98.3	1.6	12.5	0.007	0.1	20.5	9.1	525.6



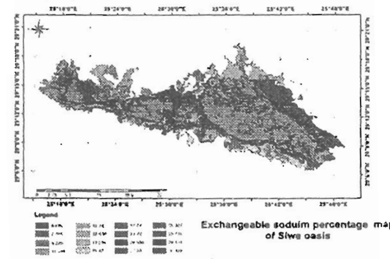
Map (5:A)



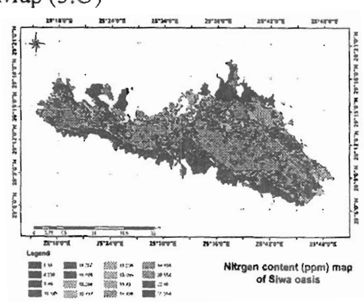
Map (5:B)



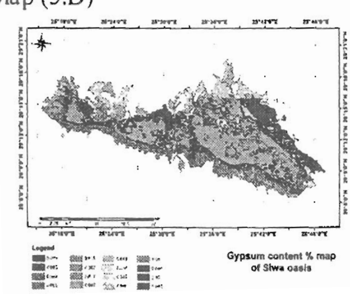
Map (5:C)



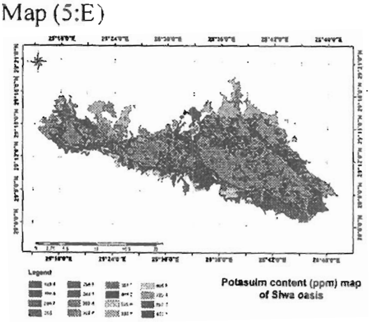
Map (5:D)



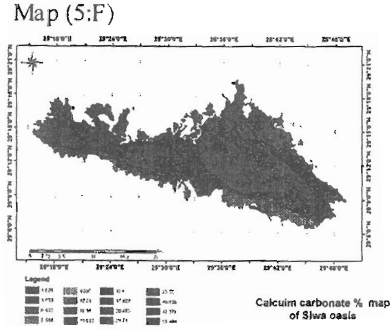
Map (5:E)



Map (5:F)



Map (5:G)

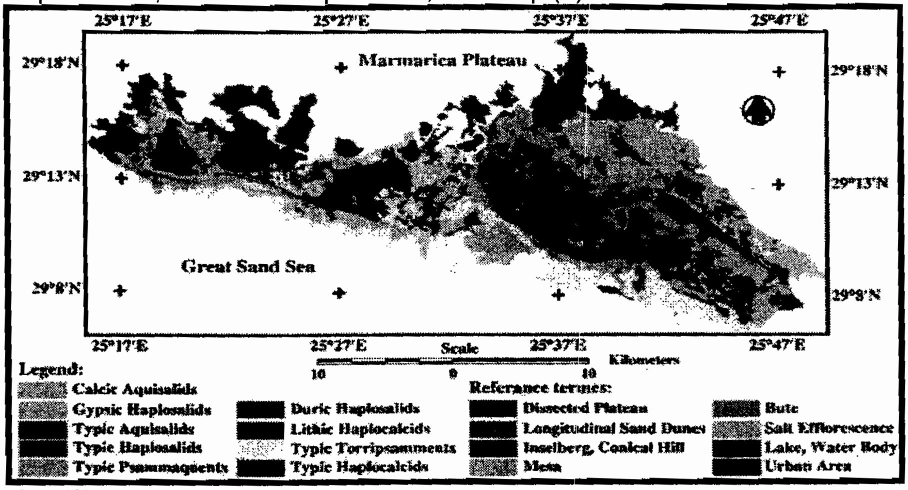


Map (5:H)

Map (5) The chemical analysis of the investigated area.

Soil map:-

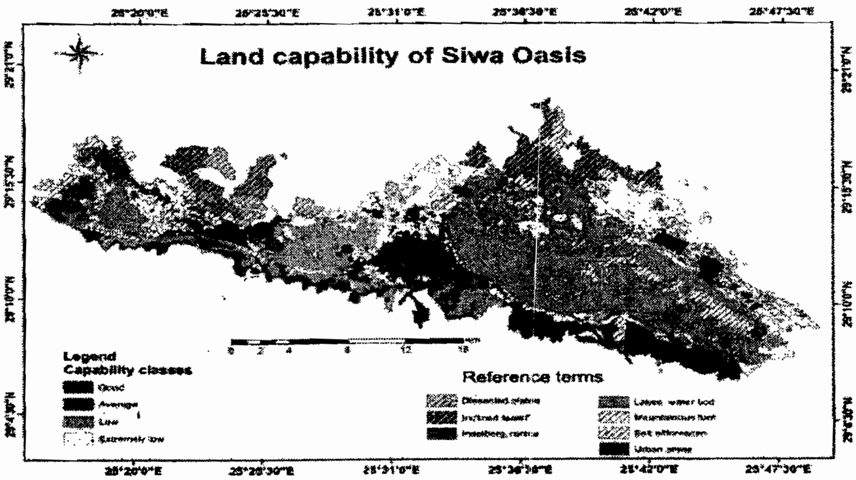
Final description of each map unit is prepared. Soil properties and soil interpretation tables are completed to confirm with the mapping units shown on the final soil map as shown in text. Based on the (USADA, 2010) Soil classification the soils of the area classified as following:- Typic Torripsamments, Typic Psammaquents, Typic Haplosalids, Typic Aquisalids, Gypsic Haplosalids, Calcic Aquisalids, Typic Haplocalcids, Lithic Haplocalcids, and Duric Haplosalids; and map (6)



Map(6)

Land Capability:-

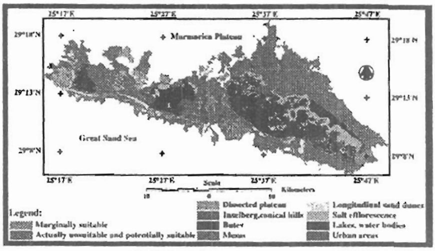
Soil capability map produced ; based on the soil properties and using Require (1970), FAO (1976), El-Toukhy (1995), and Arc GIS 10.1 , The soils of Siwa oasis are Good , Average , Low , Extremely low; and Map (7)



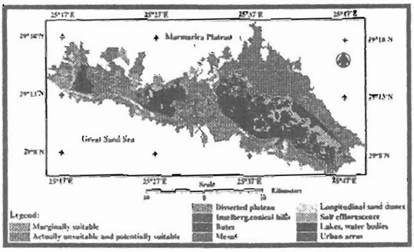
Map(7) land capability of the study area

Land Suitability:-

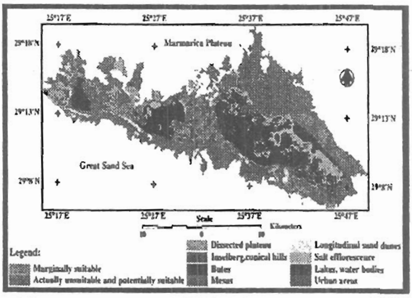
Soil suitability map produced by using ASLE and Arc GIS 10.1



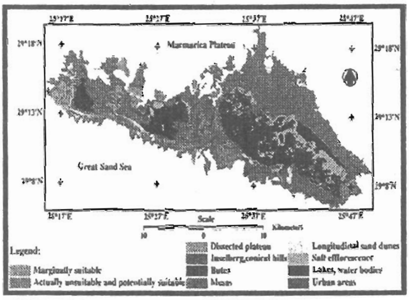
Map (8) Suitability for onion.



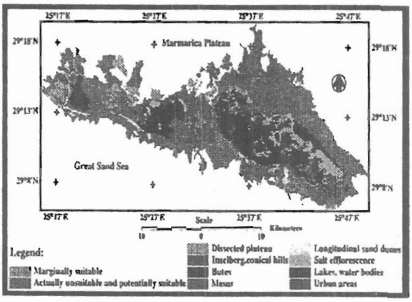
Map (9) Suitability for alfalfa.



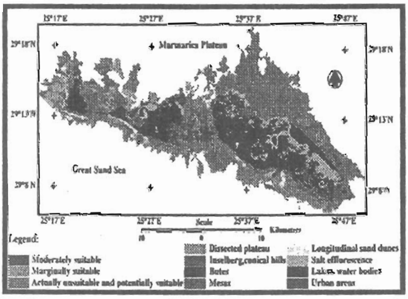
Map (10)Suitability for barley.



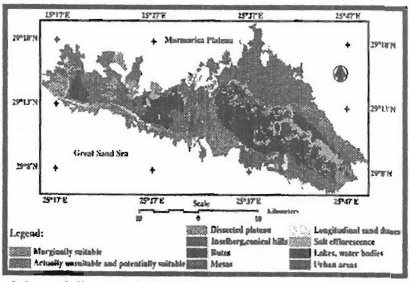
Map (11)Suitability for green pepper.



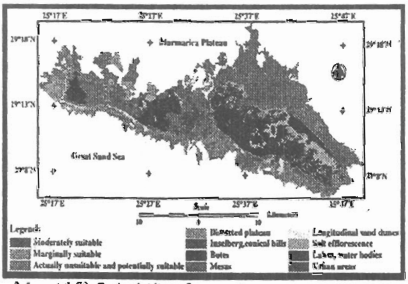
Map (12)Suitability sugar cane.



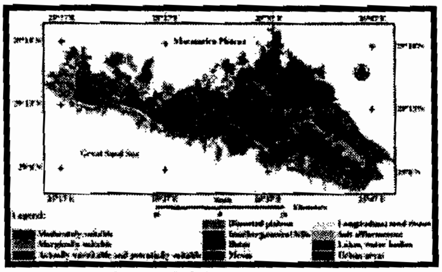
Map (13) Suitability for olives.



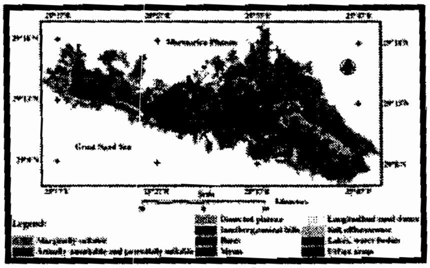
Map (14) Suitability for tomato.



Map (15) Suitability for maize.



Map (16) Suitability for wheat.



Map (17)Suitability for date palm.

According ASEL program the soil suitability of Siwa oasis for alfalfa, green pepper, onion, olives, maize, barley, sugar cane, tomato, wheat, date palm, and wheat ranged between marginal and unsuitable.

CONCLUSION

Siwa oasis is a narrow depression located in the west of the western Egyptian desert, approximately 300 km south from the Mediterranean coast in correspondence south of the city of Marsa Matruh between longitudes, 25° $16'$ - 26° $7'$ E and latitudes, 29° $7'$ - 29° $21'$ N. It extended for about 70km in east-west direction, with a width of 7-10km. The total area of Siwa Oasis about 2,950 sq. km representing the ideal continuation towards west of the larger depression of Qattara. This area has always been confined as a possible area for reclamation and utilization due to its location and the presence of ground water in a suitable quality for irrigation. The dominant texture class varied from sand , loamy sand, sandy loam ; and silty loam From table (4) and maps (5) clear that the soil reaction (pH) ranged between 7.4 and 9.3 which could be referred to increased in alkali in some units. $CaCO_3$ content ranged between 10 and 51.4% except soil profiles 6, 9, 10, 14, and 17 were less than 10% which could be referred to the calcareous sediments of parent material. gypsum content were less than one in the dominant profiles excepted soil profiles 5, 10, 11, and12 ranged between 1.59 and 5.04% . O.M% values are less than one except in profiles 2, 3, 5, 6, 11, 12, and 14 are ranged between 1.01 and 2.6% . EC (dS/m) values are ranged between moderate and high as 2.6 and 98.3 which could be referred to the ground water is near from the surface and parent material except soil profiles 3, 4, 5, 6 are low than 2 dS/m. Available values of Nitrogen (ppm) ranged between 5.5 and 22.4 (ppm) which refereed to decrease organic matter. Available of phosphorus values ranged between 2.8 and 20.8 (ppm) which refereed to fixate by parent material. Available values ranged between 186.6 and 606.8 (ppm). Keys to Soil Taxonomy (USDA 1999) were used to classify the different soil profiles according to the morphological description of the investigated soil profiles and the data extracted. Arc GIS 10.1 utility and its spatial analyst extension (ESRI 2012) Basied (USDA 1999) the soils of the area under investigated classified as Typic Torripsamments, Typic Psammaquents, Typic Haplosalids, Typic Aquisalids, Gypsic Haplosalids, Calcic Aquisalids, Typic Haplocalcids, Lithic Haplocalcids, and Duric Haplosalids. According to the morphological description of the investigated soil profiles and the data extracted. Arc GIS 10.1 utility and its spatial analyst extension (ESRI 2012) based on require (1970) .... the soil capability of the investigated area varied from Good , Average , Low ,and Extremely low which refried to the problems in the soil properties as soil parent material, soil depth soil texture, EC ,ESP , water table depth. According to the morphological description of the investigated soil profiles and the data extracted. Arc GIS 10.1 utility and its spatial analyst extension (ESRI 2012) Based on ASSEL program the soil suitability of the investigated area for alfalfa, green pepper, onion, maize, barley, sugar cane, tomato, wheat, and wheat ranged between marginal and unsuitable except olives, and date palm, ranged between moderate and unsuitable which could be referred to problems in the soil properties, climate of the area and the soil management.

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دراسه الموارد الارضيه بواحه سيوه با ستخدام تقنيتي الاسشتشعار عن بعد ونضم المعلومات الجغرافيه (gis)

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** الهيئه القتوميه للاستشعار عن بعد و علوم الفضاء - القاهره

المنطقة محل الدراسه تقع في الصحراء الغربية بواحة سيوة، والمحدده بين خط طول -١٦ °٢٥، -٧ °٢٦ وخط عرض -٧ °٢٩، -٢١ °٢٩ والتي تمتد الى حوالي ٧٠كم من الشرق الى الغرب واتساعها يتراوح بين ٧-١٠كم حيث اضهرت التحاليل ان القوام السائد بها الرملي والطميي رملي والرملي طميي والسلتي طميي وكانت ارقام الحموضه (pH) تتراوح بين ٧.٤و٩.٣ ، والمحتوى من كربونات الكالسيوم يتراوح بين ١.٦و٤٢.٣ % ، والمحتوى من المادة العضوية يتراوح بين ٠.١ و٢.٦ %، والمحتوى من الجبس يتراوح بين ٠.٠١ و٥.٠٤ % ، والملوحة تتراوح بين ٠.٥ و٩٨.٣ ديسيسيمنز/متر. والسعة التبادلية الكاتيونية تتراوح بين ١.٩ و٣٥.٠٩ مليمول/كجم، والصوديوم المتبادل يتراوح بين ٦.٣ و٣٦.٤ ، والمحتوى من النتروجين الصالح يتراوح بين ١١.١ و ٥٥.٩ جزء/مليون ، والفسفور الصالح يتراوح بين ٢.٨ و٦٠.٨ جزء/مليون ، والبوتاسيوم الصالح ١٨٦.٦ و ٩٣٣.١ جزء/مليون، وعلى اساس التقسيم الامريكي ١٩٩٩. تم تقسيم اراضي المنطقة الى Typic Torripsamments, Typic Psammaquents, Typic Haplosalids, Typic Aquisalids, Gypsic Haplosalids, Calcic Aquisalids, Typic Haplocalcids, Lithic Haplocalcids, and Duric Haplosalids. وعلى اساس الخواص الارضية تبعا لنظام After Require (1970), FAO (1976), El-Toukhy (1995), Arc GIS 10.1. تم تقسيم الارض تبعا لأنتاجيتها Good , Average , Low ,and Extremely low. وعلى اساس نظام ASLE and Arc GIS 10.1. تم تقسيم الارض حسب صلاحيتها للمحاصيل حيث نجد صلاحيتها تتراوح بين marginal and unsuitable for alfalfa, green pepper, onion, maize, barley, sugar cane, tomato, wheat, فيما عدا الزيتون والنخيل نجد الصلاحية تتراوح بين متوسط وعديم الصلاحية.

قام بتحكيم البحث

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