J. Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 4 (9): 811 - 826, 2013

ASSESSMENT OF LAND DEGRADATION IN WADI EL NATRUN AREA, WESTERN DESERT, EGYPT

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ABSTRACT

Most forms of land degradation are human resource (mismanagement and misuse); some physical and chemical environmental factors are still considered. Quantitative assessment of land degradation and monitoring the changes in land qualities in Wadi El-Natrun are the main objective of this study. Physiographic map of the area was produced by using ETM+, ENVI 5.0 and ArcGIS10. Physiographic map used to determine soil profiles location and soil samples. From the physical and chemical analysis the results compared with the data extracted from Mohamed, (2011). Land degradation rate, relative extent, degree, and severity level in the study area were assessed. The results indicate that the dominant active land degradation features are; water logging, salinity, alkalinity and compaction. Based on the FAO/UNEP, (1979) program of degradation (rate, relative extent, degree, and severity) and the application on that data of water logged, salinity, alkalinity and compaction compared with Mohamed, (2011). The results indicate that the following: - there is no effect of compaction so there is no compaction degradation . Waterlogged degradation as water table depth changed from 2011 to 2013 as following (50-100 cm) the degraded area increased from (234.32 to 341.28 km^2) ,

(100-150 cm) the soil improved and the degraded area decreased (from 356.31 to 218.42 km^2) and (> 150 cm) were improved. Salinity degradation as electrical conductivity(EC dS/m) data changed from (2011 to 2013) that the (8-16 dS/m) the degraded area increased from (0.0 to 16.83 km^2), (4-8 dS/m) the soil improved and the degraded area decreased (from 190.86 to 110.43 km^2) and (<4 dS/m) the soil improved and the area increased (from 399.76 to 451.87). Alkalinity degradation data changed from (2011 to 2013) that the (>15 %) no change , (10-15%) the soil improved and the degraded area decreased (from 437.98 to 190.82 km^2) and (<10 %) the soil improved and the area increased (152.64 to 388.32 km^2)

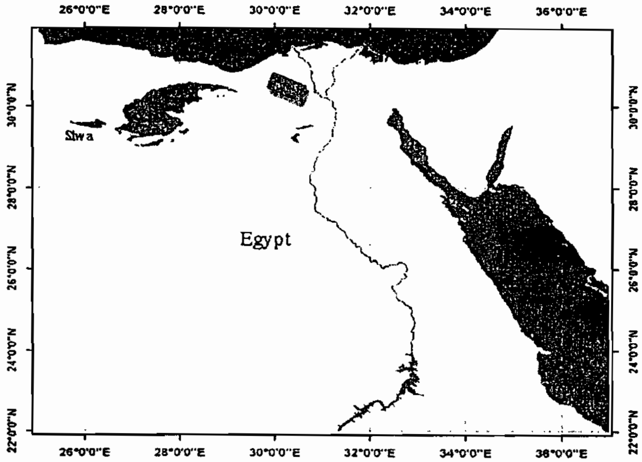
Keywords: Physiographic map, land degradation, compaction , salinity , alkalinity.

INTRODUCT ION

Wadi El-Natrun area lies to the west of Nile Delta and it is considered the natural extension of Nile Delta. The studied area lies between longitudes 30° 06′ 21".37 to 30° 28′ 50".02 East and latitudes 30° 18′ 02".88 to 30° 31′ 06".66 North. It covers an area of about 142,687 fed. (Fig. 1).

The climatic conditions of Wadi El-Natrun area are those characterizing the desert areas of Egypt. It is characterized by a hot rainless summer.(Fig1) The maximum temperature (34.5 °C) was recorded in July and August, while the minimum one (7.5 °C) was recorded in January with an average of 13.4 °C and 27.9 °C for the mean minimum and maximum annual temperature, respectively. The precipitation is rare and recorded only during

November, December, January, February, March and April. The highest value 4.9 mm was recorded in January and the lowest one 0.8 mm was recorded in April. Daily evaporation is high .



map. 1. Location of the studied area

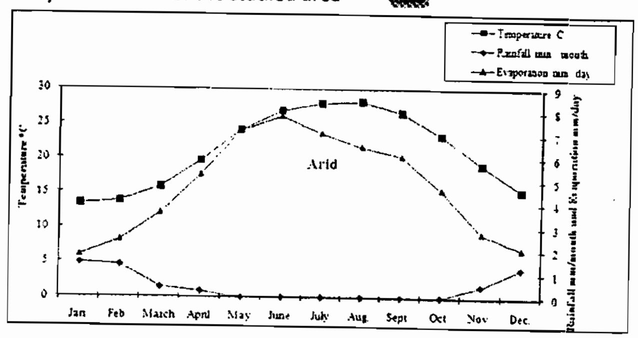


Fig. 1. Climatology of the studied area (1997 – 2006).

The lowest value of evaporation (1.8 mm/day) was recorded during January, while the highest value (7.9 mm /day) was recorded in June. After Meteorological Authority, 2006 Shata and El Fayoumy, (1970) classified the geological features of the area located between Nile Delta and Wadi El-Natrun as follows:

1. The sediments belong to the Pliocene are distributed on a large scale beneath Wadi El-Natrun area and developed into marine and fresh water faces. In the vicinity of Wadi El Natrun, the Pliocene section is thick and distinct into two main portions mostly showing slight variations among themselves, such as a lower portion composed of green sandy clays and the upper one built up by calcareous grits. Brown "Oolite" calcareous silt and sand clayey lime soil with iron oxides are associated with the Pliocene formation in Wadi El-Natrun Depression.

2. The Pleistocene and Holocene deposits are located east of Wadi El-Natrun and to the west of the Nile Delta. These sediments have distribution in the studied area and essentially developed into gravel and sand faces.

Said, (1990) stated that the western desert of Egypt stretches westwards from the Nile Valley to the borders of Libya and occupies an area (exclusive of El-Fayoum, and some natural depressions) of about 681000 km^2. It is essentially a plateau with vast expanses of rocky ground and numerous extensive and deep closed depressions. It attains its greatest altitude in the extreme southwestern corner of Egypt. It is disturbed by the great mountain mass of Gabel Oweinat lying just outside Egypt; with only the northern flames of the mountain are within the borders of Egypt. Northeast ward from Gabel Oweinat a broad tract of high ground extends for more than 200 km. This is the extensive sandstone palteau of Gilf El-Kebir, nearly 1000 m above sea level. On the other side of this tract and to its north the ground slopes gradually to the depressions in which the Oases of Abu Mungar, EL-Dakhla and El-Kharga are situated. Immediately north these Oases a high and much embayed escarpment, which is the southern edge of a great plateau of Eocene limestone. This plateau rises in places over 500 m above sea level. In this limestone plateau the great hollows containing the Oases of El-Farafra and El-Baharia are situated.

Soil texture of the investigated area is sandy with very low percentage of clay and silt, where sand percentage ranged between 90.71 to 98.52%. The gravel percentage of the surface soil is relatively high as it gravel percentage reached 34% ,Abdel-Hamid ,(2008) . Soils salinity are slightly in cultivated soils and moderately to strongly in virgin area ranged between 0.64 to 244 dS/m (Ashmawy, 2003) and (Yehia, 2004). Soil reaction (pH values) varied between 8.2 and 8.9 (Erian, (2000), Bahnassy et al,. (2001), and Ashmawy, 2003).Organic matter content ranges between 0.3 -0.8 % (Erian, 2000 and Ashmawy, 2003). calcium carbonate content ranged between 9 - 17% (Ashmawy, 2003).

Hefny ,(1993) stated that the aquifer of Wadi El-Natrun area, Wadi El-Natrun aquifer and Moghra aquifer. The upper one is Wadi El-Natrun Aquifer, which is local and of low production. It is multi-layered, with alternation of sands and clay, which belong to pliocene. The lower aquifer is the Moghra aquifer which consists of sands and gravels of the Moghra formation. Oligocene basalt or oligocene shale underly the aquifer.

Attia, (1975) The most natural vegetation, which exist in the studied area is annual weeds that flourish during the rainy season. The soil surface is barren, with regard to vegetation, which only small patches (depressions) are covered with natural vegetation, typical of the Western Desert of Egypt as: Artemisia monosperma, Pityranthus tostuesus, Aristida pliniosa, and other common perennial species.

Geographical Information Systems (GIS) have proved to be immensely helpful in the organization of the huge database generated through space technology (Trotter, 1991). The utility of GIS in the analysis and modeling of integrated information is well established (Burrough, 1986).

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 (Clark, 1991). 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. Clark (1991) shows the types of plants growing in a field. Because stressed vegetation looks different from healthy vegetation, mapped remote sensing information can be an indication of plant disease or drought.

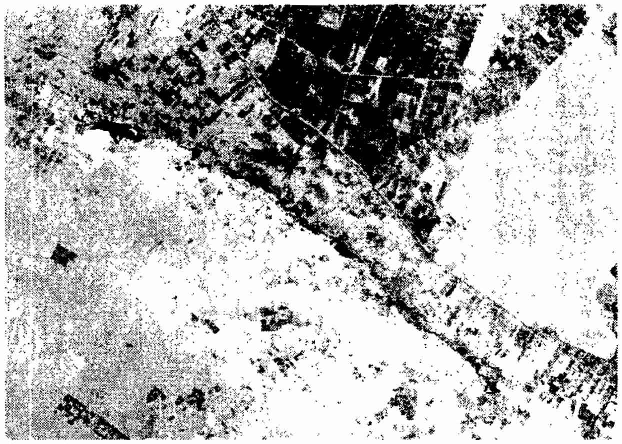
Soil degradation is defined as the process which lowers (quantitatively or qualitatively) the current and/or the potential capability of s oil to produce goods or services . Soil degradation implies a regression in capability from a higher to lower state; a deterioration in s oil productivity and land capability, Mashali, (1991), Ayoub , (1991), UNEP Staff, (1992), Wim,. and El Hadji., (2002).The food gap due to increasing population puts more pressure on the us e of land resulting in serious forms of land degradation. These are considered irreversible processes particularly with the severe and continued misuse and poor management. The intensification of agriculture coupled with poor management accelerates the rate of land degradation. Food supply situation will be worse in the future if the current trend of land degradation does not change drastically. The livelihoods of more than 900 million people in some 100 countries are now directly and adversely affected by land degradation United Nations , (1994) Unless the current rate of land degradation is s lowed and reversed, food security of humanity will be threatened and the ability of poor nations to increase their wealth through improved productivity will be impeded. Land degradation can be observed in all agro climatic regions on all continents . Although climatic conditions , such as drought and floods , contribute to degradation, the main causes are human activities . Land degradation is a local problem in vas t number of locations , but it has cumulative effects at regional and global scales .The countries of the developing world, and particularly those in the arid and semi- arid zones , are the most seriously affected UNEP Staff, (1986). The status of s oil degradation is an expression of the severity of the process . The severity of the processes is characterized by the degree in which the s oil is degraded and by the relative extent of the degraded area within a delineated physiographic unit UNEP Staff, (1991).

The main objectives of this investigation was to study the quantitative

assessment of land degradation and monitoring the changes in land qualities in wadi
El-Natrun .

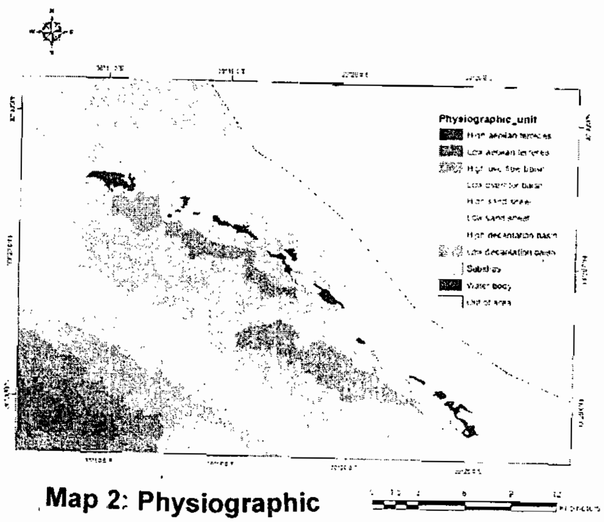
MATERIALS AND METHODS

The Physiographic Map extracted by using ETM+ taken during the year 2005 (Fig. 2).



(Fig. 2): ETM+ image of the studied area

ENVI 5.0 and ArcGIS 10.1 software has been us e d to produce the physiographic map of the studied area (Map.2 and table 1)



Map 2: Physiographic

Table (1) physiographic legend of studied area

physiograp units	land form	Area Km2	Area%
Terrais	High aeolian	11.01	1.25
	Low aeolian	16.83	1.92
Decantation basin	High decantation	242.69	27.67
	Low decantation	36.69	4.18
Overflow basin	High overflow	19.79	2.26
	Low overflow	35.25	4.02
Sand sheet	High	305.12	34.79
	Low	196.37	22.39
Sapkhas		6.15	0.70
Water body		7.19	0.82
		877.08	100.00

Soil analysis

The studied area representative by 8 different mapping units as shown in legend. 16 soil profiles were represented the mapping units and 60 minpits taken to corrected the boundaries of mapping units , the soil profiles were dug and descripted according to FAO guidelines **FAO, (2010).** The soil samples collected to preparing for laboratory analyses . physical analyses(texture class, bulk density gm/cm^3) and chemical analyses as (pH reaction , O.M % , calcium carbonate % , EC dS/m , CEC meq/L , ESP%) using the s oil survey laboratory methods manual USDA, (2004) . The American Soil taxonomy USDA ,(2010) was used to classify the s oil of the studied area.

Soil degradation assessment :

Based on the comparing between the data extracted from Mohamed, 2011 and the data resulting from this study. The FAO/UNEP,(1979) methodology for assessing soil degradation was used and the results were evaluated and confirmed with the physiographic units, the ratings used are presented in Tables (2 and 3).

Table(2) Soil degradation types, classes and rates

Chemical degradation	Salinization (Cs) increase in (EC) per dS/m/year	Alkalinization (Ca) increase in ESP/Year
Non to slight	<0.5	<0.5
Moderate	0.5 – 3	0.5 – 3
High	3 – 5	3 – 7
Very high	>5	>7
Physical degradation	**Compaction/increase in bulk density per g/cm^3/year**	**Water logging/increase in water table in cm/year**
Non to slight	<0.1	<1
Moderate	0.1 – 0.2	1 – 3
High	0.2 – 0.3	3 – 5
Very high	>0.3	>5

Table(3) Criteria used to determine the degree of the different degradation types

Hazard type	Indicator	Unit	Hazard class			
			Low	Moderate	High	Very high
Salinization	EC	dS/m	4	4 – 8	8 – 16	>16
Alkalinization	ESP	value	10	10 – 15	15 – 30	>30
Compaction	Bulk density	g/Cm^3	1.2	1.2 – 1.4	1.4 – 1.6	>1.6
Water Logging	Water Table level	cm	150	150 – 100	100-50	<50

Land degradation degree, relative extent, severity level and causative factors were defined and described using the UNEP, (UNEP Staff, 1991) approach. The relative extent of each type of soil degradation within the mapped unit is recognized as :The s oil degradation severity level is indicated by the combination of the degree and the relative extent as shown in (Table 4&5).

Table (4): The severity level of soil degradation

Category	% of the mapping unit
1. Infrequent	up to 5%
2. Common	6-10%
3. Frequent	11-25%
4. Very frequent	26-50%
5. Dominant	over 50%

Table(5): Relative extant (%) of degradation soil

Degree of soil degradati on	Relative extent (%)				
	0-5	6-11	11-25	26-50	50-100
S light	1.1	1.2	1.3	1.4	1.5
Moderate	**2.1**	**2.2**	**2.3**	**2.4**	**2.5**
Strong	3.1	3.2	3.3	3.4	3.5
Extreme	4.1	4.2	4.3	4.4	4.5

Low	Moderat e	High	Very high

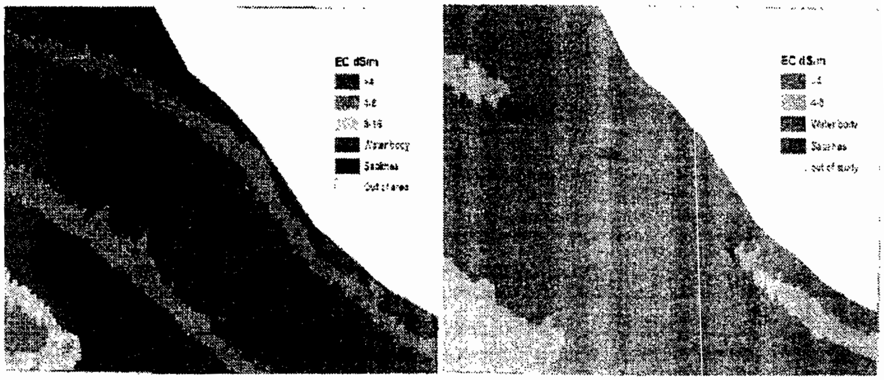
RESULTS AND DISCUSSION

Morphological features of the studied area :-

16 soil profiles representative the main physiographic units of the studied area were descripted as show in Table (6) and samples collected for laboratory analyses as the following :-

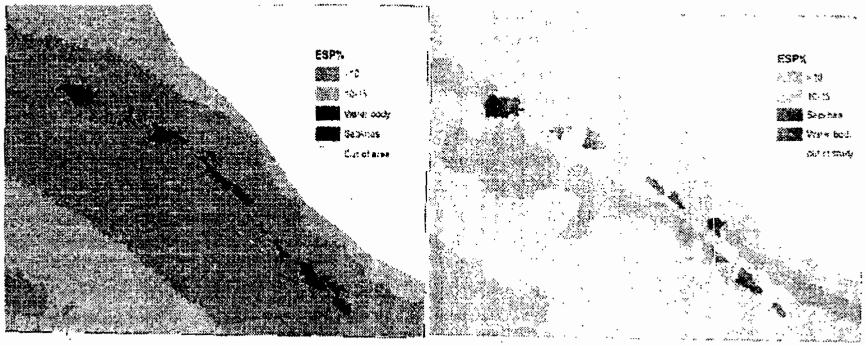
The physical and chemical analysis of the studied area were shown in Table (7)

The variation in electrical conductivity between the studied (2010 and 2013)shown in (Map.3)



(Map.3) electrical conductivity 2010 to 2013

The variation in the Alkalinity between the studied (2010 and 2013) (Map.4)



(Map.4) Alkalinity 2010 to 2013

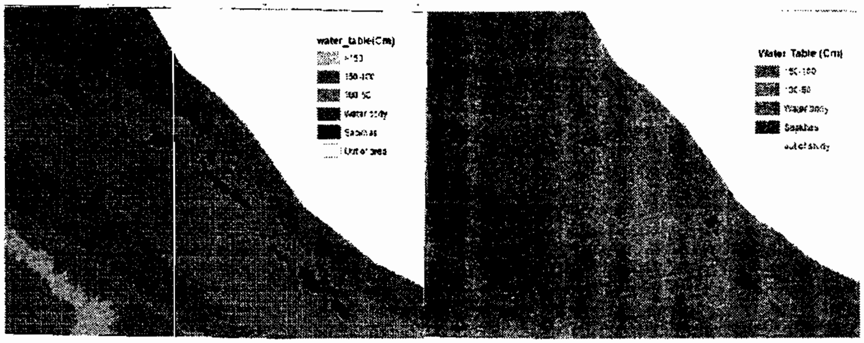
The variation in the waterlogging between the studied (2010 and 2013) (Map.5)

Table (6) : The soil profile description of the studied area.

Profile No	Depth in cm	Slope	Color		Texture class	Structure	consistency	stickiness	plasticity	carbonates	Boundary	Cementation	Other
			Dry	moist									
1	0-20	G	BY	BY	S	MG	SHA	SST	SPL	SL	D	Y	Shells
	20-90		BY	BS	S	MM	SHA	SST	SPL	SL	D	Y	-
	90-150		BY	BY	S	MM	SHA	NST	NPL	SL	D	Y	Few Gravels
2	0-20	G	YE	YE	S	SG	SHA	NST	NPL	ST	D	W	-
	20-100		YE	BY	S	SG	SHA	NST	NPL	EX	C	M	Shells
	100		Petrocalcic horizon –discontinuous hard pan.										
3	0-15	F	YB	BY	S	MM	SHA	NST	NPL	SL	D	W	-
	15-70		YE	BY	S	MW	SO	NST	NPL	SL	D	W	Shells
	70-120		YB	BY	S	MW	SO	NST	NPL	SL	D	W	-
4	0-15	U	BY	BS	S	SG	HA	NST	NPL	ST	D	Y	-
	15-90		BY	BY	S	MW	HA	NST	NPL	EX	C	Y	Shells
	90		Petrocalcic horizon –discontinuous hard pan.										
5	0-25	A	Y	YB	S	SG	LO	NST	NPL	SL	D	Y	Shells
	25-100		Y	BY	S	SG	LO	NST	NPL	ST	C	M	-
	100		Petrocalcic horizon –discontinuous hard pan										
6	0-15	G	BY	BY	S	SG	LO	NST	NPL	SL	D	Y	Many Gravels
	15-90		BY	BY	S	MM	SHA	NST	NPL	ST	C	M	Common Gravels
	90		Petrocalcic horizon –discontinuous hard pan.										
7	0-30	G	Y	YB	S	SG	LO	NST	NPL	MO	D	W	Few Gravels
	30-90		YE	BY	S	SG	LO	NST	NPL	MO	D	W	Few Gravels
	90-120		YB	BY	S	MW	SO	NST	NPL	SL	D	W	Few Gravels
8	0-20	G	BY	Y	S	SG	HA	NST	NPL	SL	D	Y	Shells
	20-70		Y	Y	S	SG	HA	NST	NPL	SL	D	Y	-
	70-110		Y	BY	S	MW	LO	NST	NPL	SL	D	Y	-
9	0-30	G	BY	BY	S	SG	LO	SST	SPL	SL	D	Y	Shells
	20-130		BY	BS	S	SG	LO	SST	SPL	SL	D	Y	Shells
10	0-25	G	YE	YE	S	SG	SHA	NST	NPL	MO	D	W	Few Gravels
	25-110		YE	BY	S	SG	SHA	NST	NPL	MO	D	W	Few Gravels
11	0-20	F	YB	BY	S	SG	LO	NST	NPL	SL	D	Y	Shells
	20-80		YE	BY	S	MW	SO	NST	NPL	SL	D	Y	Shells
	80-130		YB	BY	S	MW	SO	NST	NPL	SL	D	Y	Few Gravels
12	0-30	U	BY	BS	S	MM	HA	NST	NPL	ST	C	Y	Few Gravels
	90		Petrocalcic horizon –discontinuous hard pan.										
13	0-20	A	Y	YB	S	SG	LO	NST	NPL	MO	D	W	Shells
	20-130		Y	BY	S	SG	LO	NST	NPL	ST	D	M	Few Gravels
14	0-10	G	BY	BY	S	SG	LO	NST	NPL	MO	D	W	Few Gravels
	10-120		BY	BY	S	SG	HA	NST	NPL	ST	D	M	Few Gravels
15	0-20	G	Y	YB	S	SG	LO	NST	NPL	SL	D	Y	Few Gravels
	20-70		YB	BY	S	SG	LO	NST	NPL	ST	C	Y	Common Gravels
	70		Petrogypsic horizon –discontinuous hard pan.										
16	0-25	G	BY	Y	S	SG	LO	NST	NPL	SL	D	Y	Few Gravels
	25-80		Y	Y	S	MM	LO	NST	NPL	ST	C	Y	Few Gravels
	80		Petrocalcic horizon –discontinuous hard pan.										

Table (7: physical & chemical analyses of the studied area

Rep. Profile No.	Depth in cm	Particle size distribution %							Texture class	pH	O.M. %	$CaCO_3$ %	EC dS/m pest	Na meq./100	CEC meq./100 gm Soil	ESP %	Available macro nutrients (ppm)		
		>2mm	1-2	1-0.5	0.5-0.25	0.25-0.125	0.125-0.053	< 0.053									N	P	K
1	0-20	0	7.2	35.4	18.7	36.9	1.8	1	Sands	7.3	0.41	3.3	3.1	1.7	16.7	10.18	10.2	7.3	198.4
	20-75	0	15.3	32	29.5	19.5	2.9	0.8	Sands	7.5	0.18	12.5	5.8	1.2	7.2	16.67	7.4	4.1	124.1
	75-150	1.4	2.3	22.2	45	28	2	0.5	Sands	7.8	0.09	5.7	12.2	0.8	9.4	8.51	-	-	-
2	0-25	0	11.8	23	38.3	17.8	7.6	1.5	Sands	7.2	0.47	7.5	4.43	2.2	14.3	15.38	7.2	4.2	101.3
	25-100	0	1.4	18.2	54.3	21.9	3.5	0.7	Sands	7.8	0.13	19.2	8.2	1.3	7.2	18.06	5.5	3.4	91.7
	100-150	0	1.2	18.4	48.5	28.6	2.8	0.5	Sands	7.8	0.18	10.6	8.7	0.7	4.1	17.07	-	-	-
3	0-25	0	9.4	39	23.6	26	1	1	Sands	7.5	0.34	7.8	10.25	0.6	3.8	15.79	12.3	4.3	98.7
	25-70	0	4.6	47.5	23.8	19.8	3	1.3	Sands	7.7	0.19	5.6	12.3	1	4.7	21.28	8.6	4.1	88.6
	70-150	0	3.9	38.3	12	42.8	2.5	0.5	Sands	7.8	0.1	4.2	7.6	0.3	3.1	9.68	-	-	-
4	0-25	0	3.7	40.2	20.6	33	1	1.5	Sands	7.9	0.42	9.3	5.3	2.1	14.3	14.69	9.3	5.3	166.4
	25-90	0	7.5	25.1	46.8	17.6	2	1	Sands	8.1	0.28	15.5	18.6	1	7.2	13.89	6.8	4.1	143.8
	90-150	0	6.2	34.5	43.3	14.6	1.2	0.2	Sands	7.7	0.1	8.2	8.7	0.4	4.2	9.52	-	-	-
5	0-25	0	4	34.2	43.3	17.2	0.4	0.6	Sandy	7.2	0.25	2.7	7.2	0.7	3.6	19.44	12.2	6.4	134.6
	25-75	0	13	47.8	33	4.6	1.4	0.2	Sandy	7.5	0.17	3.4	5.8	0.5	3.1	16.13	5.7	4.2	104.3
	75-100	0	11.3	46.6	32.5	6.4	2.4	0.8	Sandy	7.6	0.12	3.2	4.7	0.8	4.1	19.51	-	-	-
6	0-30	0	4.3	40.5	20.1	31.2	2.4	1.5	Sands	7.5	0.28	4.2	5.12	1.1	7.6	14.47	4.3	6.4	168.1
	30-80	0	8.3	26.1	40.8	16.5	7.2	1.1	Sands	7.4	0.14	5.3	4.3	1.3	6.8	19.12	3.6	3.8	116.6
	80-150	0	6.3	34.4	36.6	15.6	6.3	0.6	Sands	7.3	0.12	2.7	9.6	0.9	4.9	18.37	-	-	-
7	0-30	1.5	18.7	17.3	24.2	25.6	9.3	3.4	Sands	7.6	0.24	5.3	6.3	2.5	16.3	15.34	14.3	6.3	116.4
	30-90	1.8	15.4	20.4	23.8	28.6	4	6	Sands	7.4	0.19	3.4	3.8	1.4	7.5	18.67	8.5	4.6	92.7
	90-150	2.3	15.1	21.1	23.6	32.9	7.9	6.1	Sands	7.6	0.1	3.2	4.2	0.7	4.2	16.67	-	-	-
8	0-20	0	4.5	34	3.3	52.8	4.6	0.8	Sands	7.4	0.16	5.6	77.3	5.7	25.5	22.35	12.4	3.6	145.6
	20-40	0	4.5	36.2	23.8	34.3	0.7	0.5	Sands	7.5	0.11	5.3	22.6	6.4	23.8	26.89	9.5	2.5	106.1
	40-	water table																	
9	0-30	0	5.4	48.12	15.9	28.1	1.9	0.58	Sands	7.7	0.25	3.3	4.2	1.1	7.5	14.67	6.3	2.7	134
	30-75	0	11.7	33.5	28.4	21.2	3.6	1.6	Sands	8	0.11	2.1	5.4	0.9	6.9	13.04	7.4	2.6	115.3
	75-150	0	6.4	43.7	17.9	26.3	4.4	1.3	Sandy	7.8	0.1	1.8	3.2	1.6	8.2	19.51	-	-	-
10	0-25	0.56	16.4	28.44	30.3	18.2	5.1	1	Sands	7.5	0.23	5.5	4.5	2.2	16.5	13.33	12.6	7.3	198.3
	25-80	1.64	6.8	23.95	34.9	27.3	4.8	0.61	Sands	7.7	0.14	8.2	4.2	0.8	7.3	10.96	7.8	5.9	127.4
	80-15	0.34	7.3	34.5	32.1	17.7	4.3	1.76	Sands	7.7	0.11	6.3	6.2	0.4	4.8	8.33	-	-	-
11	0-20	0	7.7	44.92	20.1	22.6	2	2.98	Sands	7.5	0.3	4.1	1.5	0.5	7.1	7.04	13.4	7.5	189.4
	20-80	0	5.2	54.6	21.9	16.3	1	1	Sands	7.7	0.1	2.6	0.8	0.3	3.1	9.68	8.6	6.6	137.1
	80-150	0	4.97	41.33	16	30.1	5.8	1.8	Sands	7.6	0.1	0.9	1.2	0.7	7.4	9.46	-	-	-
12	0-30	0	8.1	36.3	23.2	26.2	4.1	0.7	Sands	7.7	0.2	4.5	3.8	2.2	14.8	14.86	11.5	7.4	99.3
	30-90	0	9.8	35.7	25.6	24.8	3.5	0.6	Sands	7.4	0.12	6.10	6.4	1.4	11.4	12.28	7.8	3.2	90.4
	90-150	0.32	16.7	37.3	22.4	18.7	3.6	0.8	Sands	7.4	0.11	3.4	5.1	0.7	6.8	10.29	-	-	-
13	0-20	0	1.7	46.3	13.6	35.7	1.9	0.8	Sandy	7.7	0.2	9.7	4.65	4.6	27.4	16.79	7.2	3.2	102.2
	20-90	1.3	5.2	38.4	21	28.9	4.7	0.5	Sands	8	0.1	10.1	2.87	6.3	41.6	15.14	9.8	2.7	95.1
	90-	Petrocalcic horizon-discontinuous hard pan																	
14	0-30	1.2	3.3	33.8	11.6	25.3	3.1	1.7	Sands	7.4	0.21	4.2	4.34	3.8	21.3	17.84	4.4	2.1	104.3
	30-100	4.7	2.1	44.8	20.4	11.5	5	1.5	Sands	7.8	0.13	7.11	5.11	5.1	31.6	16.14	3.1	1.8	78.4
	100-	Petrocalcic horizon-discontinuous hard pan																	
15	0-20	4.6	4.5	46.6	17.2	21.1	3.3	2.7	Sands	7.4	0.30	2.4	5.3	2.7	17.1	15.79	6.2	3.4	124.4
	20-90	10.7	6.8	43.4	19.8	15.4	2	1.9	Sands	7.6	0.1	1.3	8.2	2.2	13.7	16.06	4.7	2.1	114.7
	90-	Petrogypsic horizon-discontinuous hard pan																	
16	0-25	0	0.7	49.4	16.2	30.8	1.6	1.3	Sands	7.3	0.2	3.9	3.2	1.3	8.2	15.85	11.3	8.3	243.6
	25-80	0	2.8	57.8	19.5	17.5	1.5	0.9	Sands	7.7	0.1	2.2	3.8	0.8	7.4	10.81	8.2	6.4	212.8
	80-150	0	0.7	55.6	22.5	18.7	1.3	1.2	Sands	7.5	0.8	1.5	4.1	0.4	3.8	10.53	-	-	-



(Map.5) Waterlogging 2010 to 2013

Land degradation of the soil :-

Based on UNEP Staff, (1991) the soil degradation calculated as the following :-

Table (8) B:the final Land degradation rates from compared between the studied (2010-2013):

Profile No.	Mapping unit	Water logging	Compaction	Salinity	Alkalinity
1	LSS	1	1	1	1
2	LDB	1	1	1	1
3	HAT	1	1	1	1
4	HDB	1	1	1	1
5	HSS	1	1	1	1
6	LOB	1	1	1	1
7	LAT	1	1	1	1
8	HOB	1	1	1	1

1= Low 2= Moderate 3= High

From Table (8) clear that the compared between studied of the area 2010 and 2013 there is no differentiation in the data of water logged , compaction , salinity and alkalinity and the rates of the degradation is low

Table (9) The main causative factors of human induced land degradation types in the studied area.

Profile No.	Mapping unit	Water logging	Compaction	Salinity	Alkalinity
1	LSS	i/o	O	O	O
2	LDB	i/o	O	O	O
3	HAT	i/o	O	Mi	O
4	HDB	i/d/o	O	O	O
5	HSS	i/o	O	O	O
6	LOB	i/o	O	Mi	O
7	LAT	i/o	O	O	O
8	HOB	i/o	O	Mi	O

i: over irrigation, **mi**: Poor management of irrigation scheme,

m: improperly timed used of heavy machinery. **d**: human intervention in natural drainage **o**: other activities which include (shorting of the follow periods and the absence of conservation measurements from the Table (9) clear that the over irrigation and other activities were the first factors caused the degradation , poor management of irrigation scheme were the second factors of soil degradation and human intervention in natural drainage were the third factors of causative land degradation .

Table (10): Land degradation status in the different mapping unit of the studied area:

Mapping unit	Land degradation status
LSS	(Pw i/ o 1,4) & (Pc m/o 1,5) & (Cs mi 1,5) (Ca mi 1,5)
LDB	(Pw i/ o 1,3) & (Pc m/o 1,5) & (Cs mi 1,5) (Ca mi 1,2)
HAT	(Pw i/ o 1,4) & (Pc m/o 1,5) & (Cs mi 2,5) (Ca mi 1,5)
HDB	(Pw i/ o 2,3) & (Pc m/o 1,5) & (Cs mi 1,2) (Ca mi 1,2)
HSS	(Pw i/ o 1,4) & (Pc m/o 1,5) & (Cs mi/o 1,4) (Ca mi 1,5)
LOB	(Pw i/ o 1,3) & (Pc m/o 1,5) & (Cs mi 1,4) (Ca mi 1,2)
LAT	(Pw i/ o 1,4) & (Pc m/o 1,5) & (Cs mi 1,5) (Ca mi 1,5)
HOB	(Pw i/ o 2,3) & (Pc m/o 1,5) & (Cs mi 1,2) (Ca mi 1,2)

The following one or two letters= causative factors as,

The first two letters = degradation types as, I → over irrigation

Pw → physical degradation/ water logging. d→ human intervention in natural drainage.

Pc→ physical degradation/ soil compaction. m→ improperly time use of heavy machinery.

Cs→ chemical degradation/ Salinity mi→ poor management of irrigation scheme.

Ca → chemical degradation/ alkalinity o→ other activities

From the Table (10) the dominant land degradation states in whole area caused by physical (water logging and compaction) and chemical (salinity and alkalinity) with some causative factors (over irrigation , heavy machinery , poor management of irrigation scheme , over activities) , but the area units different in severity level

From degraded studied area clear that there is no effect of compaction so there is no compaction. Waterlogged degradation as water table depth changed from 2011 to 2013 as following (50-100 cm) the degraded area increased from (234.32 to 341.28 km^2) , (100-150 cm) the soil improved and the degraded area decreased (356.31 to 218.42 km^2) and (> 150 cm) were improved. Saliniity degradation as electrical conductivity(EC dS/m) data changed from (2011 to 2013) that the (8-16 dS/m) the degraded area increased from (0.0 to 16.83 km^2), (4-8 dS/m) the soil improved and the degraded area decreased (190.86 to 110.43 km^2) and (<4 dS/m) the soil improved and the area increased (399.76 to 451.87). Alkalinity degradation data changed from (2011 to 2013) that the (>15 %) no change , (10 -15%) the soil improved and the degraded area decreased (437.98 to 190.82 km^2) and (<10 %) the soil improved and the area increased (152.64 to 388.32 km^2)

CONCLUSION

Wadi El-Natrun area lies to the west of Nile Delta and it is considered the natural extension of Nile Delta. The studied area lies between longitudes 30° 06′ 21".37 to 30° 28′ 50".02 East and latitudes 30° 18′ 02".88 to 30° 31′ 06".66 North. T he total area of Wadi El Natrun is about 281.7 K m 2 (i.e. 67608 feddans), extended in a N W -SE direction and 23 m below sea level. T his area has always been confine d a s a possible area for reclamation and utilization due to its location and the presence of ground water in a suitable quality for irrigation. T he origin of the underground water in W adi El-Natroun is seepage from the Nile stream , due to its proximity and low level (E l M aghraby, 199 0). Most forms of land degradation are human resource (mismanagement and misuse); some physical and chemical environmental factors are still considered. Quantitative assessment of land degradation and monitoring the changes in land qualities in Wadi El-Natrun are the main objective of this study . physiographic map of the area produced by using ETM+, ENVI 5.0 and ArcGIS10 . physiographic map used to determined soil profiles location and soil samples. From the physical and chemical analysis the results compared with the data extracted from Mohamed (2011). Land degradation rate, relative extent, degree, and severity level in the study area were assessed. The results indicate that the dominant active land degradation features are; water logging salinity, alkalinity and compaction . Based on the program FAO/UNEP(1979). of degradation (rate, relative extent, degree, and severity) and the application on that data of water logged salinity alkalinity and compaction compared with Mohamed (2011). clear that the following :- there is no effect of compaction so there is no compaction. Waterlogged degradation as water table depth changed from 2011 to 2013 as following (50-100 cm) the degraded area increased from (234.32 to 341.28 km^2) , (100-150 cm) the soil improved and the degraded area decreased (356.31 to 218.42 km^2) and (> 150 cm) were improved. Salinity degradation as electrical conductivity(EC dS/m) data changed from (2011 to 2013) that the (8-16 dS/m) the degraded area increased from (0.0 to 16.83 km^2), (4-8 dS/m) the soil improved and the degraded area decreased (190.86 to 110.43 km^2) and (<4 dS/m) the soil improved and the area increased (399.76 to 451.87). Alkalinity degradation data changed from (2011 to 2013) that the (>15 %) no change , (10-15%) the soil improved and the degraded area decreased (437.98 to 190.82 km^2) and (<10 %) the soil improved and the area increased (152.64 to 388.32 km^2)

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تقييم تدهور الأراضى بمنطقه وادى النطرون , الصحراء الغربيه , مصر

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معظم أشكال تدهور الأراضي هي الموارد البشرية (سوء الإدارة و سوء الاستخدام) ؛ تعتبر بعض العوامل البيئة الفيزيائية والكيميائية هي الاساس في هذا التدهور .
التقييم الكمي لتدهور الأراضي ورصد التغيرات في صفات الأراضي في وادي النطرون هي الهدف الرئيسي من هذه الدراسة .
تم إنتاج خريطة جغرافية للمنطقة باستخدام صور القمر الصناعي (+ ETM)،وانتاجها باستخدام برامج ENVI 5.0 و ArcGIS10
خريطة جغرافية طبيعية استخدمت لتحديد ملامح التربة الموقع و عينات من التربة . من التحاليل الفيزيائية والكيميائيوة مقارنة النتائج مع البيانات المستخرجة من محمد ، (2011) .
تم تقييم معدل تدهور الأراضي ، مدى النسبية ، ودرجة التدهور ، و مستوى خطورة التدهور في منطقة الدراسة . وتشير النتائج إلى أن تدهور الأراضي بالموقع والتي تم الاعتماد عليها لاستخراج النتائج هي
(التشبع والملوحة و الثلوية و التضاغط)، على أساس برنامج منظمة الأغذية والزراعة / برنامج الأمم المتحدة ، (1979) للتدهور (معدل التدهور ومدى النسبية ، ودرجة الدهور ، وشدة التدهور) و تطبيقها على تلك البيانات (التشبع ، والملوحة ، والقلوية و التضاغط) مقارنة مع محمد ، (2011) .
وتشير النتائج إلى أن ما يلي : – ليس هناك أي تأثير ملموس في تضاغط التربة، اما التدهور بالنسبة للتشبع بالمياه من حيث عمق منسوب المياه الجوفية فقد تغيرت من 2011الى 2013 على النحو التالي (50–100 سم) زادت المساحة المتدهورة من (234.32الى341.28 كم^2) ،(100-150)(سم) تحسنت و انخفضت المنطقة المتدهورة (356.31الى218.42 كم^2) وكذلك تحسنت المناطق ذات الاعماق (< 150 سم). بالنسبة للتدهور بالملوحة و الموصلية الكهربائية / EC DS) م) فان البيانات التي تغييرت من (2011–2013) أن (8-16 dS/m) فان المساحة المتدهورة ارتفعت من (0.0الى 16.83 كم^2)،(4-8 dS/m) فان التربة تحسنت وانخفاض المساحة المتدهورة (190.86 الى 110.43 كم2) وكذلك (<4 dS/m) قد تحسنت التربة و مساحة التحسن (399.76 الى 451.87 كم^2) . بالنسبة لبيانات التدهور على اساس القلوية فقد طرأ تغيير على المنطقة خلال الفترة (2011–2013) أن (< 15٪) لا تغيير ، (10–15 ٪) تحسين التربة وانخفاض منطقة المتدهورة (437.98 الى 190.82 كم^2) و (<10 ٪) قد تحسنت التربة و زادت المساحة (152.64 الى 388.32 كم^2) .

قام بتحكيم البحث

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