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Impact of Soil Degradation on Land Qualities of some Areas of El-Qaluibiea Governorate, Egypt

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SOIL degradation is defined as a process, which lowers (quantitatively or qualitatively) the current and/or the potential capability of soil to produce goods or services. Soil degradation implies a regression from a higher to lower state; a deterioration in soil productivity and land capability.

The main objective of this study is to produce a geometrically corrected physiographic-soil map of scale 1: 100.000 reduced to the attachment map scale 1: 250.000 for the studied areas as a base for monitoring the changes in land qualities. This part of study based on the comparison between the data extracted from the reports and the data of this study carried out in the year 2005 for 15 selective profiles in seven representative districts of Qaluibiea Governorate.

Based on the aerial photo-interpreation and GIS tools coupled with the field work and laboratory analysis data, the physiographic soil map was produced. The result indicated that the studied areas is considered as unstable ecosystem due to active degradation resulting from climate, relief, soil properties and unproper farming system. The most active land degradation features are; Waterlooging. Salinization, Alkalinization and Compaction. GLASOD Approach is used in land degradation assessment.

Keywords: Land degradation, Monitoring the changes in land qualities, El- Qalubiea.

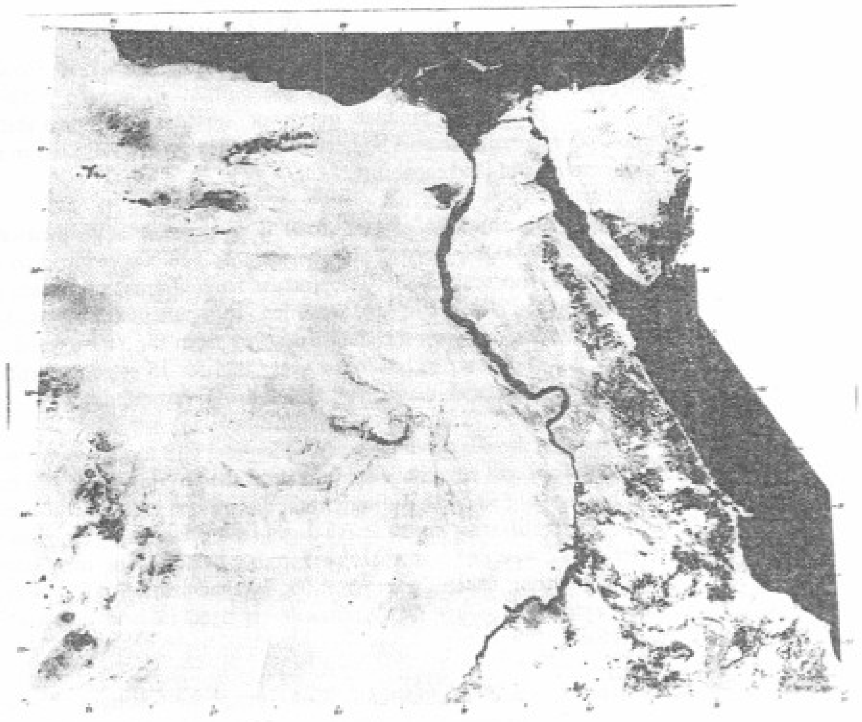
Most forms of land degradation are man-made problems. Although there are some physical environmental factors evolved, but misues and mismanagement are important factors. The food gap due to increasing population put more pressure on the use of land resulting in serous forms of land degradation which considered as irreversible process with the sever and continued misuse and poor management. The intensification of agriculture 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 did not change drastically.

Soil degradation is defined as a process, which lowers (quantitatively or qualitatively) the current and/or the potential capability of soil to produce goods or services. Soil degradation implies a reression from a higher to lower state; a deterioration in soil productivity and land capability, (Mashali, 1991; Ayoub, 1991; UNEP ,1992 and Wim & Elhadji, 2002).

Description of the studied area

Location

The studied area incorporates an area of approximated 224363 feddans. It is bounded by longitudes 31°10 W and 31° 30 E & latitudes 30° 10 S and 30° 35N, (Fig. 1).



The studied area

Fig .1. The location of the studied Area .

Climate

Using Egyptian meteorological Authority (1996) and Soil Survey Staff (1999). The soil temperature regime of the studied area could be defined as thermic and soil moisture regime as torric.

Geology

Said (1993) reported that the studied area belongs to the late Pleistocene which represented by the deposits of the neonile broke into Egypt sometime in the earlier part of this age and also by the deposits which accumulated during the recessional phases of this river. Through its history the neonile in this massif has been continuously lowering its course at a rate of 1m/1000 years.

Material and Methods

Aerial photo-interpretation

Panchromatic aerial photographs scale (1: 40,000) which were taken during the year (1991) average consisting of 61 aerial photographs have been used for the present study.

All photographs were analyzed stereoscopically and further division made using "the physiographic analysis" detailed by Bulter (1959); Vink (1963); Goosen (1967); Ligterink(1968); Bennerma & Gelons (1969) and Zink & Valenzuala (1990). The main elements used are slope, relief, greytone, in addition to parceling and natural vegetation, so the physiographic map has been obtained.

Field work

To fulfill the objective of this study 15 soil profiles were chosen in seven districts to represent the different soil units. Morphological description was carried out following the guidelines edited by FAO(1990).

Laboratory analysis

Disturbed soil sample were collected for laboratory analysis, which include the following:

- Mechanical analysis (Piper ,1950 and Klut ,1986).
- $CaCO_3$, O.M & EC (Jackson ,1967 and USDA ,1991).
- Soil reaction pH (Richard ,1954).
- Cation exchange, (Piper, 1950 as modified by Ghoer,1954).
- Exchangeable sodium according to Tucker modified method (1971).
- Available N.P.K. (Jackson ,1967 and Page *et al.*, 1982).
- Soil Color by Munssel Color Charts (Soil Surrey Staff, 1975).

Integration of the data in a soil map

- Soil taxonomy (Soil Surrey Staff 1991), were used to classify the different soil profiles.
- The soil correlation between the physiographic and taxonomic units, were designed in order to identify the major soil sets of the studied area, after Elberson & Catalan (1987).
- ARC-info program has been used as the main GIS software for this study.

Land degradation status

This part of study based on the comparing between the data extracted from RISW report (1967) and the data of the field work carried out in the year (2005) by the author.

Based on soil, topography and climatic factor which defined and describe by using FAO/UNEP (1978) and (1979) methodology for assessing soil degradation, the natural vulnerability for each soil profile were evaluated and confirmed with the physiographic units.

The rating used are present in Tables 1&2. Moreover, the soil degradation classed and rates are shown in Table 3.

The status of soil degradation is an expression of the severity of the process. The severity of the processes is characterized by the degree in which the soil degraded and by the relative extent of the degraded area with in a delineated physiographic unit. Degree, relative extent, severity level and causative factors were defined and described by using the GLASOD approach (UNEP,1991) as the following:

1. Degree of soil degradation

The criteria used to determined the degree of land degradation are shown in Table 4.

2. Relative extent of the degradation type

It is not possible to separate areas of soil degradation individually on the map. It is however possible to estimate the relative extent of each type of soil degradation within the mapped unit. Five categories are recognized:

1. Infrequent :up to 5% of the unit is affected.
2. Common: 6-10% of the unit is affected.
3. Frequent: 11-25% of the unit is affected.
4. Very frequent: 26-50% of the unit is affected.
5. Dominate over: 50% of the unit is affected.

3. The severity level of soil degradation

The severity level is indicated by the combination of the degree and the relative extent as shown in Table 5.

4. Causative factors

The dominate causative factors of the different types of land degradation were identified in the field and also collected from the available technical reports.

TABLE 1. Rating for physical vulnerability.

Factor	Index	Class			
		Low	Moderate	High	Very high
Climate	$\sum p^2/p-$	0-50	50-500	500-1000	>1000
Soil	Slit%/Clay%	<0.2	0.2-0.3	0.3-0.7	>0.7
Topography	Slope %	0-2	2-8	>8	-

Adapted FAO(1978), p= monthly precipitation, p-=annually precipitation

TABLE 2. Rating for chemical vulnerability.

Factor	Index	Class			
		Low	Moderate	High	Very high
Climate	PET/(P+Q)10	<0.1	0.1-0.3	0.3-0.5	>0.5
Soil	Texture class	Clay	Silt	Sand	-
Topography	Slope %	0-2	2-8	>8	-

Adapted FAO(1978)- PET= potential evapo-transpiration p = precipitation/year Q=irrigation water.

TABLE 3. Soil degradation 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

Adapted FAO (1979).

TABLE 4. Criteria used to determine the degree of the different degradation types.

Critical/Hazard type	Indicator	Unit	Class			
			Low	Moderate	High	Very high
Salinization	Ec	dS/m	4	4-8	8-16	>16
Alkalinization	ESP	%	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

TABLE 5. The severity level of soil degradation.

Degree of soil degradation	Relative extent (%)				
	0-5	6-11	11-25	26-50	50-100
Slight	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

The severity classed

Low	Moderate	High	Very high

Results and Discussion

Physiographic and soil map

The obtained physiography and soil map, Map 1 and Table 6 reveled that, the Island soils occupies about 0.59% of the investigated area, while the sub-Island soils form about 1.120% and the levee soils form about 1.44%.

The over flow mantle soils form 14.26, the over flow basin from about 27.17%, the decantation basin form about 48.34%, the turtle backs from 0.27% and the sequence of river terraces form about 6.81%.

Soil classification

According to the recent American soil taxonomy(1999), studied soils could be classified as:

- I, Typic Torripsamment (cons.)- SI, Typic Torripsamment (cons.)
- L, Typic Torripsamment (cons.)- O.M, Typic Torrifluvent (cons.)
- O.M, Typic Paleargids (Assoc.)- O.B, Vertic Torrifluvent (cons.)
- O.B, Typic Natrargids (Assoc.)- D.B, Typic Torrifluvent (Cons.)
- T.B, Typic Torripsamment (Assoc.)- T, Vertic Torrifluvent (Cons.)

The physiographic & soil map legend of the investigated area are shown in Table 6.

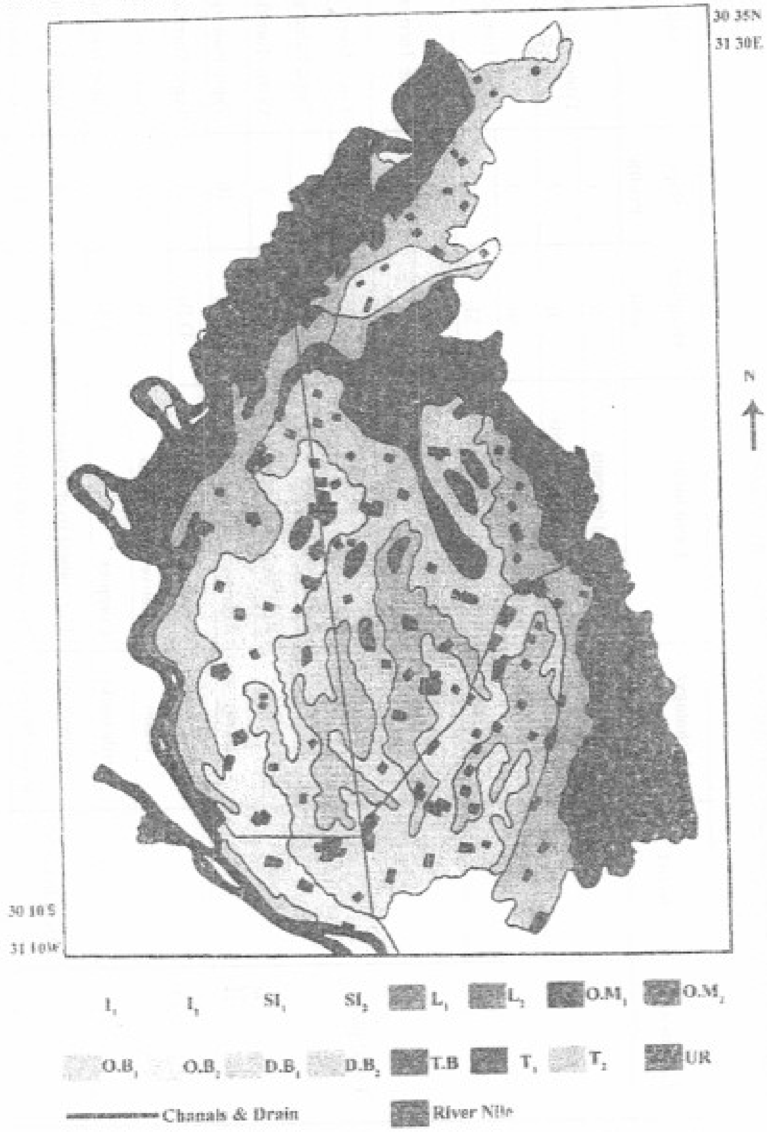
Land degradation assessment

Natural vulnerability of the studied area

Table 7 represents the natural vulnerability and its relative extent (%) of the different mapping units in the studied area. The obtained data reveal that, the soils of (I, SI, L, O.M, T.B & T) have a physical degredation ranging from mod. in profile no. (5, 6, 7, 8, 14 & 15) to high risk in profiles no. (1, 2, 3, 4, & 13). The high risk of the physical degradation type is related to high content of silt and low percentage of organic matter. While, the soils of (O.B & D.B) have a slight physical degradation related to low content of silt and high percentage of organic matter.

Besides, the soils of (I, SI, L, O.M, T.B & T) have a chemical degradation risk ranging from slight in profiles no (1, 2, 3, 4, 5, 6, 13, 14 & 15) to mod. Risk in profiles (7&8). While, the soils of (O.B & D.B) have a high chemical degradation risk due to the high evapotransipiration value compare with the amount of precipitation and irrigation water.

The relative extent (%) of the natural vulnerability classes in the studied area are shown in Table 8.



Map .1. Physiographic- soil map of the studied area .

TABLE 6. Physiographic and soil map legend of the investigated area.

Landscape	Relief	Lithology/ origin	Land form	Mapping unit	Rep. Profile	Soil sets	Type of Soil Sets
Flood plain	Nile deposits	Recent Islands	Recent sand deposits	I_1	1	Typic Torripsamment	Cons.
			Sub-recent sand deposits	I_2	2		
		Sub-recent Islands	Recent sand deposits	SI_1	3	Typic Torripsamment	Cons.
			Sub- recent sand deposits	SI_2	4		
	Basin	Levees	Recent sand deposits	L_1	5	Typic Torripsamment	Cons.
			Sub- recent sand deposits	L_2	6		
		Over flow Mantle	Relatively high parts	$O.M_1$	7	Typic Torrifluvent	Cons.
			Relatively high parts	$O.M_2$	8	Typic Paleargids	Assoc.
		Over flow Basin	Relatively high parts	$O.B_1$	9	Vertic Torrifluvent	Cons.
			Relatively high parts	$O.B_2$	10	Typic Natrargids	Assoc.
		Decantation Basin	Relatively high parts	$D.B_1$	11	Typic Torrifluvent	Cons.
			Relatively high parts	$D.B_2$	12	Typic Torrifluvent	Cons.
		Turtle backs	Complex	T.B	13	Typic Torripsamment	Cons.
	River terraces	Sequence of River Terraces	The highest river terraces	T_1	14	Vertic Torrifluvent	Cons.
			The lowest river terraces	T_2	15	Vertic Torrifluvent	Cons.

TABLE 7. Physical and chemical degradation classes according to the natural factors in the studied area.

File No.	Mapping unit	Location	Physical degradation					Chemical degradation				
			C	S	T	Value	Class	C	S	T	Value	class
1	I_1	El-Monera, El kanater El Kherea	1.0	1.90	1	0.22	High	0.21	0.3	1	0.07	Slight
2	I_2	Gezerat Bata, Banha	1.0	1.88	1	0.21	High	0.21	0.3	1	0.07	Slight
3	SI_1	Tant El gezera, Tokh	1.0	1.83	1	0.21	High	0.21	0.2	1	0.06	Slight
4	SI_2	Gezerat el aga, Tokh	1.0	1.81	1	0.21	High	0.21	0.2	1	0.06	Slight
5	L_1	Demlo, Banha	1.0	1.80	1	0.20	Mod.	0.21	0.1	1	0.05	Slight
6	L_2	Tahla, BANHA	1.0	1.75	1	0.20	Mod.	0.21	0.1	1	0.05	Slight
7	$O.M_1$	Namol, Tokh	1.0	0.91	1	0.10	Mod.	0.21	0.6	1	0.10	Mod.
8	$O.M_2$	Kafr el Hareth, El-kanater el kherea	1.0	0.90	1	0.10	Mod.	0.21	0.5	1	0.10	Mod.
9	$O.B_1$	Asnet, kafr shokr	1.0	0.69	1	0.07	Slight	0.21	1	1	0.21	High
10	$O.B_2$	Kafr ragab, kafor skokr	1.0	0.67	1	0.07	Slight	0.21	1	1	0.21	High
11	$D.B_1$	Manshet sheben, Sheben el kanater.	1.0	0.58	1	0.05	Slight	0.21	1.2	1	0.22	High
12	$D.B_2$	Nay, kalub	1.0	0.51	1	0.05	Slight	0.21	1.2	1	0.22	High
13	T.b	Kafr alwan, Tokh	1.0	1.90	1	0.2	Mod	0.21	0.3	1	0.07	Slight
14	T_1	Saraykos, el khanka	1.0	1.45	1	0.14	Mod.	0.21	0.3	1	0.07	Slight
15	T_2	El kalg, El khanka	1.0	1.12	1	0.11	Mod.	0.21	0.3	1	0.07	Slight

Slight (<0.1), moderate (0.1-0.2), High > (0.2); C=Climate, S=Soil, T=Topography

Human induced land degradation

The human induced land degradation in the studied areas were assessed throughout the identification of the rate, degree, relative extent, causative factors, and severity level of each type of land degradation (water logging, compaction, salinization, and alkalinizatin) for the different mapping units as the following:

TABLE 8. Relative extent (%) of the natural vulnerability classes in the studied area.

Lapping unit	Area feddan	Relative extent %					
		Physical degradation			Chemical degradation		
		Slight	Moderate	High	Slight	Moderate	High
I	861.39	0.2	18.0	81.8	88.5	11.4	0.1
SI	1642.76	0.9	20.9	78.2	80.6	19.2	0.2
L	2116.80	2.2	79.5	18.3	79.8	19.8	0.4
O.M	20913.82	1.3	75.6	23.1	1.6	80.1	18.3
O.B	39841.59	78.1	21.5	0.4	0.2	23.9	75.9
D.B	70893.74	83.9	16.0	0.1	-	15.1	84.9
T.B	391.48	-	19.9	80.1	-	8.6	91.4
T	9991.79	8.9	76.4	14.7	79.4	20.4	0.2

Land degradation rate

The rate of land degradation were estimated by the comparing between the main land characteristics as studied in (1967) and (2005) as illustrated in Table 9 the rate of land degradation for each mapping unit were classified to slight as shown in Table 10 the obtained data reveals that, the reat of salinization, alkalinization and compaction, are slight, the annual increases of EC, ESP and bulk density were reached to (0.1 dS/m), (0.2%) and (0.01 g/cm^3) respectively. The rate of water logging in the studied area is slight to moderate as the maximum increase of water table is (1.7 cm/year).

TABLE 9. Monitoring of the main land characteristics in the studied area.

Profile No.	Mapping unit	Depth of water table level (cm)		Bulk density* g/cm^3		EC* ds/m		ESP*%	
		1967	2005	1967	2005	1967	2005	1967	2005
1	I_1	100	65	1.10	1.12	2.62	4.31	8.7	10.1
2	I_2	110	80	1.10	1.13	3.24	4.00	9.0	11.3
3	SI_1	100	70	1.13	1.14	3.00	4.21	8.4	10.2
4	SI_2	100	80	1.15	1.16	3.72	5.10	8.1	9.6
5	L_1	110	75	1.12	1.15	3.18	6.19	9.2	11.3
6	L_2	100	65	1.14	1.15	4.00	6.18	9.1	11.2
7	$O.M_1$	120	100	1.30	1.35	5.31	9.21	9.0	15.0
8	$O.M_2$	130	100	1.27	1.31	6.00	10.41	10.6	15.8
9	$O.B_1$	120	90	1.29	1.35	6.49	11.23	15.0	16.1
10	$O.B_2$	120	100	1.26	1.29	7.24	10.17	15.9	19.8
11	$D.B_1$	110	90	1.24	1.42	5.14	9.16	15.8	19.3
12	$D.B_2$	120	70	1.30	1.46	6.25	9.00	15.4	17.9
13	T.B	150	125	1.16	1.17	3.90	6.91	14.5	15.3
14	T_1	120	100	1.18	1.19	2.81	4.83	9.4	11.4
15	T_2	110	95	1.15	1.18	3.19	5.20	7.8	10.1

*Calculated till the depth to 100 cm.

TABLE 10. Land degradation rates in the different mapping units of the studied area.

Profile No.	Mapping unit	Location	Water loggind	Compaction	Salinization	alkalinization
1	I_1	El-Monera, El kanater El Kherea	2	1	1	1
2	I_2	Gezerat Bata, Banha.	1	1	1	1
3	SI_1	Tant El Gezera, Tokh	1	1	1	1
4	SI_2	Gezerat El Aga, Tokh.	1	1	1	1
5	L_1	Demlo, Banha	2			
6	L_2	Tahla, Banha	1	1	1	1
7	$O.M_1$	Namol, Tokh	1	1	1	1
8	$O.M_2$	Kafr El Hareth, El-kanater El kherea	1	1	1	1
9	$O.B_1$	Asnet, kafr shokr	1	1	1	1
10	$O.B_2$	Kafr ragab, kafor skokr	1	1	1	1
11	$D.B_1$	Manshet sheben, Sheben El kanater.	1	1	1	1
12	$D.B_2$	Nay, kalub	1	1	1	1
13	T.B	Kafr alwan, Tokh	1	1	1	1
14	T_1	Saraykos, El khanka	1	1	1	1
15	T_2	El kalg, El khanka	1	1	1	1

1= Low 2= Moderate 3= High

Degree of land degradation

In the studied area, the present values of electric conductivity, exchangeable sodium percent, bulk density and the depth of water table range between (4.00-11.23) dS/m, (9.6 -19.8)%, (1.123-1.46) g/cm^3 and (65-125)cm., respectively as indicated in Table 9. The hazards of the different types of land degradation are low to mod.

Relative extent of land degradation

The relative extent of each type of human induced land degradation in the studied areas were estimated based upon the correlation between the physiography and soils in the different mapping units, as shown in Table 11.

TABLE 11. Relative extent (%) of the land degradation types in the studied area.

Main Mapping unit	Area (Feddan)	Water logging (depth of water table in cm)			Compaction (bulk density in g/cm^3)			Salinization (EC in dS/m)			Alkalization (ESP%)		
		>100	100-75	75-50	<1.2	1.2-1.35	1.35-1.50	<4	4-8	8.16	<15	15-25	25-35
I	861.39	4.41	53.81	41.78	60.12	39.88	-	61.29	38.71	-	89.16	10.84	-
SI	1642.76	8.23	59.13	32.64	51.43	48.57	-	70.82	29.18	-	90.21	9.79	-
L	2116.80	19.80	51.03	29.17	54.90	45.10	-	8.19	90.58	1.23	82.14	17.86	-
O.M	20913.82	39.22	58.09	2.69	32.70	59.13	8.17	4.82	63.58	31.60	77.21	22.79	-
O.B	39841.59	42.17	54.65	3.18	21.16	64.02	14.82	1.20	56.98	41.82	58.8	41.2	-
D.B	70893.74	26.17	62.54	11.29	-	77.84	22.16	0.80	50.02	49.18	46.19	53.81	-
T.B	391.48	75.84	24.16	-	51.62	48.38	-	65.29	34.51	0.20	83.31	16.69	-
T	9991.79	76.28	23.72	-	54.11	45.89	-	61.11	38.49	0.40	80.26	19.74	-

Causative factors of human induced land degradation

The main causative factors of human induced land degradation types in the studied area are shown in Table 12.

TABLE 12. The main causative factors of human induced land degradation types in the studied area.

Profile No.	Mapping unit	Location	Water logging	Compaction	Salinization	alkalinization
1	I_1	El-Monera, El kanater El Kherea	i/d/o	-	-	-
2	I_2	Gezerat Bata, Banha.	i/d/o	-	-	o
3	SI_1	Tant El gezera, Tokh	i/d/o	-	-	-
4	SI_2	Gezerat El Aga, Tokh.	i/d/o	o	-	o
5	L_1	Demlo, Banha	i/d/o	o	o	-
6	L_2	Tahla, Banha	i/d/o	o	o	o
7	$O.M_1$	Namol, Tokh	i/o	m/o	mi	mi
8	$O.M_2$	Kafr el Hareth, El-kanater El kherea	i/o	m/o	mi	mi
9	$O.B_1$	Asnet, kafr shokr	i/o	m/o	mi	mi
10	$O.B_2$	Kafr ragab, kafor skokr	i/o	m/o	mi	mi
11	$D.B_1$	Manshet sheben, Sheben El kanater.	i/o	m/o	mi/o	mi/o
12	$D.B_2$	Nay, kalub	i/o	m/o	mi/o	mi/o
13	T.B	Kafr alwan, Tokh	-	-	mi	mi
14	T_1	Saraykos, El khanka	-	-	-	-
15	T_2	El kalg, El khanka	-	-	o	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.

Except some environmental processes which occur without human interference, the soil degradation is resulted when soils are not properly managed or not used in the right way . The main types of human induced land degradation in the investigated areas are , salinization , alkalinization, Soil compaction and water logging , these types are affected by the human activities as the following :-

Salinization and alkalinization

The human induced salinization and alkalinization can result of the three causes , first , it can be the result of poor management of irrigation schemes .A high salt, content of the irrigation water or too little attention given to the drainage of irrigated fields can easily lead to rapid salinization and or alkalinization . This type of salt accumulation mainly occurs under arid and semi-arid condition .Second , salinization and or alkalinization will occur if sea water or fossil saline ground water bodies that intrude the ground water reserves of good quality. This some times happens in the coastal regions with an excessive use of ground water but can also occur in closed basin with aquifers of different salt content. A third type occurs where human activities lead to an increase in evapo-transpiration of soil moisture in areas of high salt-containing parent materials or with saline ground water.

Compaction

Compaction mainly occurs in the soils with a low structural stability , under the improper human activities . In the studied areas soil compaction was resulted from improperly timed use of heavy machinery , misuse of irrigation , absence of conservation measurements , shorting of the fallow period, and the excessive use of chemical fertilizers.

Water logging

Human intervention in the natural drainage systems by the misused irrigation water quality may lead to flooding especially in heavy clay soils. Over irrigation , insufficient drainage , and destruction of subsurface drainage networks (in some parts) are the main causes of water logging in the studied areas .

Severity level of land degradation

The severity level of land degradation is indicated by a combination of the degree and the relative extent of the degradation types are shown in Table 13 .

Status of land degradation

The obtained data of degradation rate, degree, extent, causative factors and the severity levels in the different mapping units of the studied area are shown in Table 14.

Conclusion

Generally, the soils of the studied area have a low rate of degradation for different types of human indused factors due to the low changes in the land characteristics during the period of (1967-2005). According to present value of soil depth, bulk density, electric conductivity and exchangeable sodium percentage these soils are threatened by a (low to mod.) degree of water logging, compaction, salinity and alkalinity. The mod. values of these types are due to the over irrigation, poor management of irrigation scheme, improper use of heavy machinery and the absence of conservation measurements. The severity levels of the different types of degradation in these soils are low to very high.

TABLE 13. Land degradation severity level in the studied area.

Profile No.	Mapping Unit	Water logging			Compaction			Salinization			Alkalization		
		Degree	Extent	Severity level	Degree	Extent	Severity level	Degree	Extent	Severity level	Degree	Extent	Severity level
1	I_1	3	4	3.4 / V.high	1	5	1.5 / Low	1	5	1.5 / Low	1	5	1.5 / Low
2	I_2	3	3	3.3 / high	1	5	1.5 / Low	1	5	1.5 / Low	2	2	2.2 / Mod.
3	Sl_1	3	4	3.4 / V.high	1	5	1.5 / Low	1	5	1.5 / Low	1	5	1.5 / Low
4	Sl_2	3	3	3.3 / high	1	5	1.5 / Low	2	2	2.2 / Mod.	2	2	2.2 / Mod.
5	L_1	3	4	3.4 / V.high	1	5	1.5 / Low	2	4	2.4 / high	1	5	1.5 / Low
6	L_2	3	3	3.3 / high	1	5	1.5 / Low	2	4	2.4 / high	2	2	2.2 / Mod.
7	$O.M_1$	2	2	2.2 / Mod.	2	4	2.4 / high	2	4	2.4 / high	2	2	2.2 / Mod.
8	$O.M_2$	2	2	2.2 / Mod.	2	4	2.4 / high	2	4	2.4 / high	1	5	1.5 / Low
9	$O.B_1$	2	4	2.4 / high	2	4	2.4 / high	2	4	2.4 / high	2	4	2.4 / high
10	$O.B_2$	2	4	2.4 / high	2	4	2.4 / high	2	4	2.4 / high	2	4	2.4 / high
11	$D.B_1$	2	4	2.4 / high	2	5	2.5 / V.high	2	5	2.5 / V.high	2	5	2.5 / v.high
12	$D.B_2$	2	4	2.4 / high	2	5	2.5 / V.high	2	5	2.5 / V.high	2	5	2.5 / v.high
13	T.B	1	5	1.5 / Low	1	5	1.5 / Low	2	2	2.2 / Mod.	2	2	2.2 / Mod.
14	T_1	1	5	1.5 / Low	1	5	1.5 / Low	2	4	2.4 / high	1	5	1.5 / Low
15	T_2	1	5	1.5 / Low	1	5	1.5 / Low	2	4	2.4 / high	1	5	1.5 / Low

TABLE 14. Land degradation status in the different mapping unit of the studied area.

Mapping unit	Land degradation status
I	(Pw i/d/o 3,4) (Ca o 2,2)
SI	(Pw i/d/o 3,4) (Cs o 2,2) (Ca o 2,2)
L	(Pw i/d/o 3,3) (Cs o 2,4) (Ca o 2,2)
O.M	(Pw i/ o 2,2) & (Pc m/o 2,4) & (Cs mi 2,4) (Ca mi 2,4)
O.B	(Pw i/ o 2,4) & (Pc m/c 2,4) & (Cs mi 2,4) (Ca mi 2,4)
D.B	(Pw i/ o 2,4) & (Pc m/o 2.5) & (Cs mi/o 2,5) (Ca mi 2,5)
T.B	(Cs mi 2,2) (Ca mi 2,2)
T	(Cs o 2,4)

The first two letters = degradation types as,

Pw → physical degradation/ water logging.

Pc→ physical degradation/ soil compaction.

Cs→ chemical degradation/ Salinization.

Ca → chemical degradation/ alkalinization.

The following one or two letters= causttive factors as,

I → over irrigation

d→ human intervention in natural drainage.

m→ improperly time use of heavy machinery.

mi→ poor management of irrigation scheme.
o→ other activities

* the first digit= degree of land degradation;

the second digit = relative extent of degradation

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تأثير تدهور التربة على صفات التربة لبعض مناطق محافظة القليوبية – مصر

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تعرف عمليات تدهور الأراضى على أنها العمليات التى تؤدى إلى نقص فى القدرة الإنتاجية للارض سواء كانت الحالية أو المستقبلية من حيث الكم النوع وكذلك الخدمات وتدهور الاراضى يؤدى إلى تراجع صفات التربة من الرتب العليا إلى الرتب الدنيا فى قدرة الأرض الإنتاجية.

والهدف الرئيسي من هذه الدراسة هو إنتاج خريطة فيزوجرافية أرضية مصححة مقياس ١: ١٠٠,٠٠٠ تصغر إلى الخريطة الملحقة مقياس ١: ٢٥٠,٠٠٠ لمنطقة الدراسة كأساس لتتبع التغير فى نوعية الأرض. وهذا الجزء من الدراسة يعتمد على المقارنة بين البيانات المستخرجة من تقرير حصر الأراضى الصادر عن مركز البحوث الزراعية- معهد بحوث الأراضى والمياه سنة ١٩٦٧ والنتائج المتحصل عليها من هذه الدراسة سنة ٢٠٠٥ لعدد ١٥ قطاع أرض مختارين بسبع مراكز ممثلة لأراضى المحافظة.

وبالاعتماد على تفسير الصور الجوية ونظم المعلومات الجغرافية بجانب النتائج الحقلية والمعملية تم إنتاج الخريطة الفيزوجرافية الأرضية ودلت نتائج الدراسة على أن منطقة الدراسة تعتبر نظام بيئى غير متزن ويرجع ذلك لعوامل التدهور النشطة والناتجة عن المناخ، الطبوغرافية، صفات التربة والعمليات الزراعية، حيث وجد أن أكثر العمليات النشطة فى تدهور الأراضى هى تغدق التربة/ الملوحة، القلوية وتضاغط التربة. وقد تم استخدام نظام الـ١٩٩١ GLASOD فى تقدير تدهور التربة.