J. of Soil Sciences and Agricultural Engineering, Mansoura Univ., Vol. 12 (12):867 - 874, 2021

Journal of Soil Sciences and Agricultural Engineering

Journal homepage: www.jssae.mans.edu.eg
Available online at: www.jssae.journals.ekb.eg

Impact of Urbanization on the Soil Environment in Southern Giza Governorate, Egypt

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ABSTRACT

The current study aims at quantitative monitoring of land-use changes and their impact on some properties of soil in the southern region of Giza Governorate. The geomorphological units in the study area were represented by twelve soil profiles, where each geomorphological unit was represented by two profiles, one affected by urbanization and the other unaffected. Soil samples were collected according to morphological variation and analyzed to determine some properties. Satellite images of four successive periods were processed and classified to estimate the spatial changes in land cover. The results indicated that there are four types of land cover in the studied area, water bodies, agricultural land, urban settlements, and barren land. Water bodies increased progressively during the study period from 2.7 to 8.5 percentages of the study area. Urban settlements increased from 10.8 to 26 %, while agricultural land decreased from 54.4 to 43 %. The percentage of barren lands decreased from 32 to 22.4% due to the expansion of new agricultural lands. Soil properties were seriously affected by urbanization, as the values of salinity and bulk density increased, and the depth of the soil profile decreased, in addition to a relative increase of heavy metals. Results revealed high-risk indicators concerning the loss of productive agricultural land, and the possibility of pollutants exceeding the critical level, threatening security food sustainability and thus maximizing health risks. Preventive measures must be undertaken to reduce and halt urbanization of the fertile Nile cultivated lands and the consequent aggravation of our very important resources.

Keywords: land-use change; food sustainability; health risks and Heavy metal pollution.

INTRODUCTION

The Earth's ecosystems are degraded by several factors; the most important of which at present is urban sprawl, specifically the rate of urban growth pattern. The most prominent reasons for this influence are human activities that accompany this growth such as constructions, roads, and industrial expansions. These activities affect the quality of the components of the entire ecosystem: Soil, air, and water (Ondera and Dursunb, 2011). Urbanization can be defined as a type of land use that entails the expansion of an urban area at the expense of any land cover, which is specified as urban sprawl when it replaces vegetation cover and specially cultivated areas. Today, more than half of the world's population lives in urban areas. It is expected that by 2050 this value may reach 70% (Ochoa *et al*., 2018).

The driving causes of urbanization are mainly economic such as the development of transportation infrastructure or the quality of services in one area compared to others with low economic income from agricultural activity, forcing the population to change the land use for some other activities (Fekade, 2000).

The Nile Valley and Delta are among the oldest and most densely populated agricultural lands in the world. In Egypt, especially in the Nile Valley and Delta, urban sprawl has greatly reduced agricultural land during the January 25, 2011revolution, thus reducing agricultural production of crops, orchards, and vegetables. This also led to an increase in pollution and degradation of soil and water resources, creating potential health and food security hazards (Khalifa and Gad,2018).

One of the most damaging consequences for the environment and human health is the accumulation of heavy metals in agricultural soils, which is closely related to rapid urbanization, exceeding industrial activity, and atmospheric contamination in accordance (Wu *et al*., 2016 and Zhou *et al*., 2016).

Heavy metals from human sources remain more dangerous as they are more mobile than those that occur naturally and thus can be a resource of contamination of ground and surface waters (Khalifa and Gad,2018).

Geographical information systems (GIS) and remote sensing images are effective tools for identifying and integrating spatial data with other available data, thus the possibility of monitoring change in land use and land cover is successfully monitored.

Several studies have been conducted on lands of the Nile Valley and Delta for detecting and recording urbanization activities on the valley and delta, such as (Belal & Moghanm , 2011, Hegazy & Kaloop, 2015, Al-Bilbisi, 2019 and Elagouz *et al*., 2020), however, they did not recognize the change in soil properties and pollution as a result.

The current study aims at following the changes of land use in general and urban sprawl on agricultural lands in particular, and its impact on soil and water quality in the southern region of Giza Governorate.

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DOI: 10.21608/jssae.2021.219972

MATERIALS AND METHODS

Study area descriptions

The study area is located in the south of Giza Governorate, Egypt, and within the boundaries of Al-Saff city. The study area covers an area of 135.5 km² and is located between the latitudes 29° 45 '00" and 29° 45 ' 00 "N and longitudes 31° 10' 30 "and 31° 20 '30"E (Fig.1). According to soil taxonomy, the soil temperature regime of the studied area is Thermic, and the soil moisture regime is Torric (Soil Survey Staff, 2014).

According to CONOCO, 1987, the study area is occupied by deposits belonging in general to *Quaternary* and *Tertiary* ages (Fig. 2)

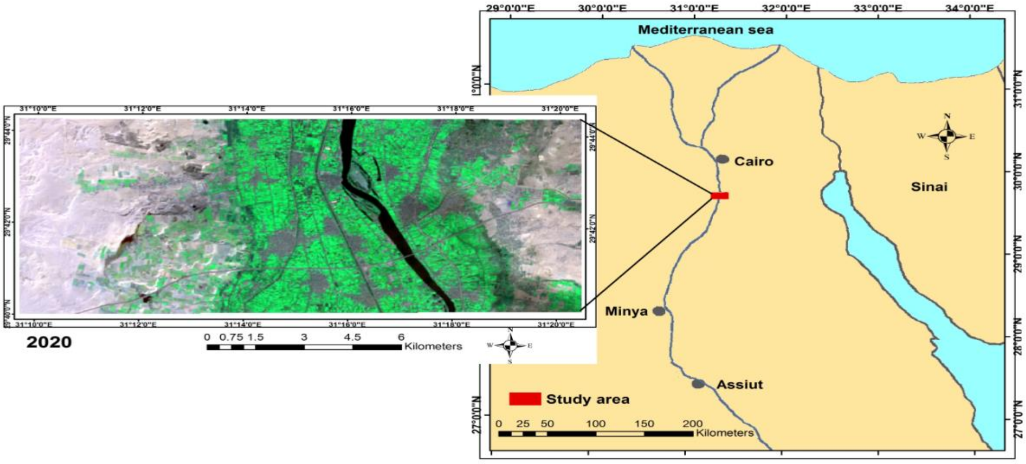


Fig. 1. Location of the study area.

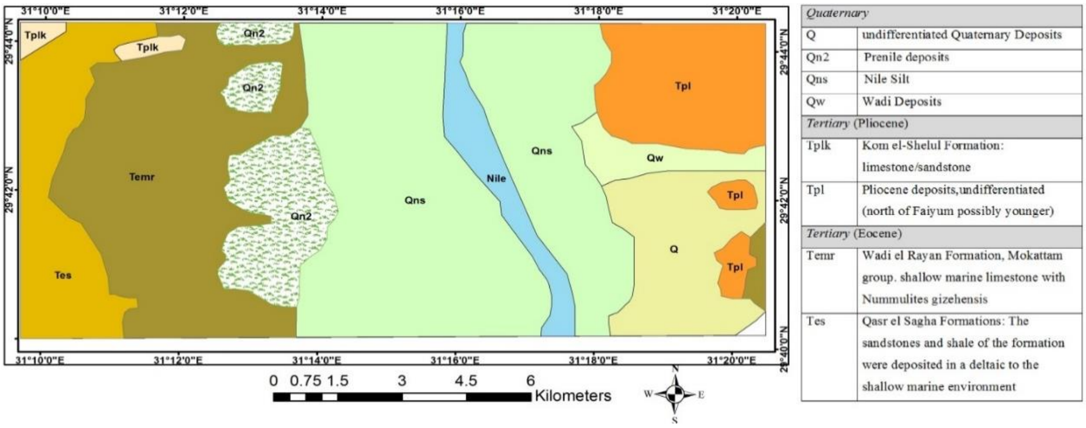


Fig. 2. Geological map of the study area

The main geomorphic units in the study area were identified as shown in Table 1 and Figure 3; according to Afify, A. A., *et al*., (2010) to include the following units:

- Pediplain: These units occurred in the eastern and western sides of the study area, having sloping gravelly and stony surfaces. They were developed as residual soil over parent martial of limestone rock.
- Terraced old alluvial plain: These terraces have gently undulating gullied and gravely surfaces having soils with developed calcic and gypsic horizons in very gravelly sandy loams
- Flat recent alluvial plain: This unit has flat surfaces and is dominated by clayey soils of the Nile flood plain.
- River Nile meandering belt: This unit has relatively coarser parent material compared to those in the flood plain. This unit in the study area include: Levees, Point bars, and Meander scar

Table 1. Percentage of the geomorphological units and the profiles represented

No.	Geomorphic unit	Symbol	Profiles No.	Taxonomy	Area %	Area km2
1	Terraced old alluvial plain	TO	1 and 2	Typic Calcigypsids	21.48	29
2	Terraced oldest alluvial plain	TOS	3 and 4	Typic Haplocalcids	22.22	30
3	Flat recent alluvial plain	FR	5 and 6	Typic Haplotorrerts	28.89	39
4	Levees	MBL	7 and 8		2.96	4
5	Point bar	MBP	9 and 10	Typic Torriorthents	3.70	5
6	Meander scar	MS	11 and 12		0.74	1
7	Pediplain	PED	-----	Lithic Haplocalcids	8.89	12
8	River Nile	RN	------		3.7	5
9	Urban settlements	US	------		8.15	11

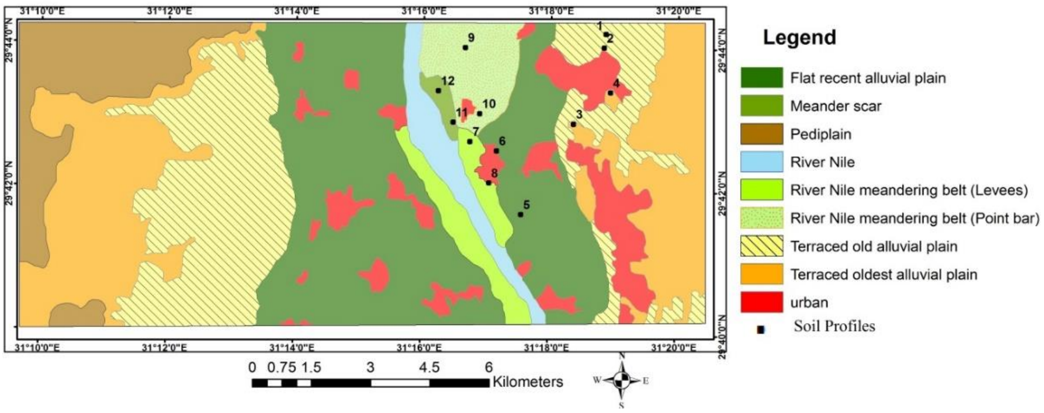


Fig. 3. Geomorphic map of the study area and location of soil profiles.

Fieldwork and laboratory analyses

Due to the similarity of the geomorphic units between East and West Nile in the study area, the focus has been on the East Nile region as accordingly represented by twelve soil profiles. The process of monitoring urban encroachments was estimated overall area. To follow the impact of urban encroachment on agricultural lands, two soil profiles were identified for each land unit, one of which is adjacent to the urban area and the second is not subject to urbanization. The soil properties in the two profiles were then compared for each unit to determine the extent of the impact of urbanization on soil properties and quality. Investigated soil profiles were described according to the Soil survey manual (USDA 2012).

After collecting the samples representing the layers of the soil profiles, they were subjected to air drying before crushing, A 2 mm sieve was used to separate fine fractions (<2mm). The samples were then stored for necessary analyses. Table 2 includes analyses performed on soil samples for the different profile layers while heavy metals were only estimated at surface layers of each profile, according to Estefan *et al*. (2013).

Table 2. Parameters and methods for analysis.

Physical parameters	Method
Bulk density (kgm-3)	Clod
Particle density(kgm-3)	Pycnometer
Mechanical analysis	Hydrometer
Chemical parameters	Method
Total calcium carbonate (%)	Calcimeter
Soil pH	pH meter (suspension 1:25)
Organic matter (OM) (%)	Walkley and Black
Cation exchange capacity (CEC) (cmol kg-1)	Extraction by sodium and ammonium acetate
Electrical conductivity (EC) (dSm-1)	In soil paste extract
Gypsum (%)	Precipitation with acetone
Available heavy metals (mg kg-1)	Extraction by DTPA , and measurement by (AAS)
Total heavy metals (mg kg-1)	Digestion by (HNO3-HCl), and measurement by (AAS)

AAS , Atomic Absorption Spectroscopy

Change detection of land use, land cover

Change detection analysis was performed and quantified between images of the same scene at different times. This analysis is very much helpful to identify various changes occurring in different classes of land use as shown by Hegazy and Kaloop (2015).

In the current study, the necessary topographic maps were acquired from competent authorities in Egypt. Satellite images needed for the study were also downloaded from USGS Earth Explorer. The pre-processing of images was undertaken, followed by classification to discover a change in urbanization at the expense of other land cover types, using Arc GIS 10.2 program.

Processing and classification of the images were carried out for four different periods, namely 2010, 2013, 2017, and 2020 to show the changes in land cover for each period separately, as shown in the following steps.

- Composite image bands for each year.
- Clip raster of each year to facilitate image processing.
- Supervised classification of each year, Where 4 categories of land cover were identified: agriculture, urban, free water bodies& sabkha, and Barren lands.
- Areas calculation of different units in images of each year.

RESULTS AND DISCUSSION

Soil properties:

In general, the results showed that the soil in the TO and TOS units had a higher percentage of total carbonates, and higher salinity compared to the soil of the rest units in the study area. The increase in salinity may be due to the effect of irrigation with industrial wastewater and sewage.

The percentage of clay and the content of organic matter were positively correlated with the percentage of water saturation percentage, and there was also a clear trend of decreasing the bulk density and increasing the porosity with the increase in the soil organic matter content.

Also, most soil profiles have salt content decreasing with depth, while the pH values are fluctuating between 7.6 - 8.6 (Tables 3, 4).

The soils are generally coarse to medium textured in high terraces and medium in the other units.

The Nile plain and all associated units are generally silt loam in texture. Texture in the TO unit is indicating a close relationship to the recent Nile system. It is just a notice which requires further peer investigation.

The bulk density values ranged from moderate to high (1.4 to 1.79 mg / m3), and the lowest value was recorded in the surface layer in TO (1.17 mg / m3), and this may be due to the relatively high content of organic matter in this layer. Other soils were having normal values of arid soils ranging between 2.8 Mgm3 in the surface layers to about 0.4 Mgm3.

Table 3. Some physical characteristics of soil profiles in the study area

Units	Profiles No.	Depth cm	% S.P	Particle size distribution (%)			Texture class	B. Density $Mg\ m^{-3}$	R. Density $Mg\ m^{-3}$	Porosity %
				Sand	Silt	Clay				
TO	1	0-25	38.41	63.84	29.66	6.5	SL	1.17	2.13	45.07
		25-60	44.68	62.41	27.68	9.91	SL	1.86	2.53	26.48
		60-75	37.20	55.66	24.11	20.23	SCL	1.87	2.62	28.63
	2	0-20	48.46	60.72	33.78	5.5	SL	1.62	2.36	31.36
TOS	3	0-20	23.45	90.35	8.35	1.3	GRS	1.4	2.66	47.37
		20-150	21.82	93.75	5.05	1.2	S	1.52	2.64	42.42
	4	0-30	30.44	80	13.64	6.36	LS	1.67	2.65	36.98
		30-65	28.20	71.49	24.25	4.26	SL	1.68	2.72	38.24
		65-115	15.97	97.1	1.7	1.2	GRS	1.68	2.72	38.24
FR	5	0-20	43.98	51.28	39.12	9.6	L	1.5	2.43	38.27
		20-120	52.76	25.4	53.7	20.9	SIL	1.51	2.47	38.87
	6	0-25	53.47	41.3	42.1	16.6	L	1.52	2.61	41.76
		25-70	50.49	26.43	54.34	19.23	SIL	1.53	2.81	45.55
		70-90	50.67	25.53	51.97	22.5	SIL	1.53	2.65	42.26
MBL	7	0-25	51.53	28.1	61	10.9	SIL	1.6	2.6	38.46
		25-60	50.36	11.7	75	13.3	SIL	1.8	2.67	32.58
		60-150	51.66	7.9	76.97	15.13	SIL	1.8	2.49	27.71
	8	0-25	45.03	22.7	68.1	9.2	SIL	1.49	2.63	43.35
		25-60	40.32	15.9	76.5	7.6	SIL	1.51	2.7	44.07
		60-150	45.43	16.3	74.4	9.3	SIL	1.74	2.76	36.96
MBP	9	0-20	41.84	31.5	52.2	16.3	SIL	1.71	2.68	36.19
		20-70	42.27	40.9	44.7	14.4	SL	1.73	2.63	34.22
		70-130	38.16	55.3	32.2	12.5	L	1.79	2.68	33.21
	10	0-20	45.63	32.8	50	17.2	SIL	1.74	2.62	33.59
		20-65	36.49	17.7	64.4	17.9	SIL	1.75	2.7	35.19
		65-125	43.68	13.5	73.2	13.3	SIL	1.75	2.71	35.42
MS	11	0-30	42.45	43.6	43.2	13.2	L	1.61	2.66	39.47
		30-70	45.88	31	52.2	16.8	SIL	1.65	2.58	36.05
		70-150	44.75	28.8	54.2	17	SIL	1.66	2.72	38.97
	12	0-30	41.00	50.7	36.2	13.1	L	1.67	2.59	35.52
		30-70	29.00	58.1	30.6	11.3	SL	1.68	2.71	38.01
		70-150	20.38	87.1	11.8	1.1	SL	1.72	2.72	36.76

SL, Sandy Loam; SCL, Sandy Clay Loam; GRS , Gravely Sand; LS, Loamy Sand; S, Sand; L, Loam; SIL, Silty loam; L, loam

Table 4 . Some chemical characteristics of soil profiles in the study area

Unit	NO.	Depth. cm	pH 1:2.5	EC $dS\ m^{-1}$	CEC $cmolc\ kg^{-1}$	OM $g\ kg^{-1}$	$CaCO_3$ $g\ kg^{-1}$	Gypsum $g\ kg^{-1}$
TO	1	0-25	7.8	46.9	26.41	51.75	24.68	3.23
		25-60	7.8	27.2	42.09	21.39	157.46	5.29
		60-75	8.2	11.8	53.03	13.11	122.68	4.90
	2	0-20	7.6	139	25.75	50.37	135.85	23.65
TOS	3	0-20	8.4	5.1	5.74	13.80	151.59	3.78
		20-150	8.7	3.1	6.77	9.66	141.34	4.04
	4	0-30	8	8.1	8.28	23.46	119.69	2.84
		30-65	8	7.3	7.22	19.32	82.67	3.70
		65-115	8.6	4	2.76	4.14	162.41	3.14
FR	5	0-20	8.1	7.8	17.78	28.29	21.98	2.49
		20-120	8.3	3.8	37.69	12.42	14.30	2.24
	6	0-25	8.1	7.5	22.08	29.67	34.34	2.80
		25-70	8.3	4.8	25.24	12.42	22.05	3.01
		70-90	8.3	4.4	43.24	8.97	14.22	3.01
MBL	7	0-25	8.2	4.8	18.61	27.60	15.46	2.75
		25-60	8.2	5	20.77	15.87	9.94	2.15
		60-150	8.3	3.5	21.17	11.73	13.20	2.28
	8	0-25	8.1	3.3	17.27	18.63	6.45	1.85
		25-60	8.4	1.9	15.32	7.59	8.36	1.51
		60-150	8.5	2.2	19.26	7.59	1.52	1.51
MBP	9	0-20	8.2	6.2	25.45	21.39	12.75	2.58
		20-70	8.3	2.5	20.11	8.28	11.52	2.24
		70-130	8.3	2	20.27	2.07	5.46	2.32
	10	0-20	8.4	3.7	31.43	26.91	21.78	2.19
		20-65	8.3	2.9	31.14	14.49	14.19	4.43
		65-125	8.4	2.8	25.11	4.14	11.57	4.04
MS	11	0-30	8.4	3.2	28.06	13.11	11.01	3.10
		30-70	8.4	2.6	30.51	7.59	10.67	3.10
		70-150	8.4	4	30.36	7.59	12.38	3.96
	12	0-30	8	4.1	38.42	33.12	5.57	1.12
		30-70	8.4	1.7	36.43	8.97	6.94	1.51
		70-150	8.2	0.9	7.10	5.52	1.57	0.30

Cation exchange capacity (CEC) was ranging from very low to very high, with the highest values recorded in the TO unit (53.03 cmolc kg^{-1}), while the lowest value was in the MBP unit (2.76 cmolc kg^{-1}), where the highest values were closely related to the increase in clay and organic matter contents.

Organic matter content was ranging from very low to low as ranging from 2.07 to 15.87 g kg^{-1} and decreasing with depth.

Total carbonate ($CaCO3$) content was slightly calcareous at units FR, MBL, MBP, and MS (1.52 to 34.34 g Kg^{-1}).

Soils of the terraces associated with Nile valley are highly calcareous with values ranging between 24.7 to 175.5 g Kg^{-1}.

Soils of the terraces associated with Nile valley (TO and TOS) are highly calcareous with values ranging between 24.7 to 175.5 g Kg^{-1}. The lower terrace exhibits leaching to the subsurface, while the oldest are affected with evaporation where carbonates are accumulated at the surface.

The studied soils are generally slightly gypsiferous. Gypsum contents ranged from 0.3 to 5.29 g Kg^{-1}, except for profile No. 2 (TO unit), where the gypsum value was 23.65 g Kg^{-1}.

Soil reaction (pH) was on the average of 8.5 to 7.8 in all studied soils.

Soils are high to moderately saline in both terraces and the old cultivated lands.

Change Detections

Temporal images consisting of four mainland classes were detected in the studyarea; urban area, agricultural land, barren land, and free water bodies & Sabkhas. Figures 4&5 and Tables 5&6 explain the thematic classified images during studied years.

Table 5. land coverage types by square kilometer for each date

Land Cover Type	2010		2013		2017		2020	
	Km2	%	Km2	%	Km2	%	Km2	%
Free water bodies and Sabkhas	3.7	2.731	6	4.428	8	5.904	11.5	8.487
Agriculture	73.8	54.46	70.2	51.81	64	47.23	58.6	43.25
Urban	14.6	10.77	24.6	18.15	25	18.45	35.1	25.9
Barren land	43.3	31.96	34.7	25.61	38.5	28.41	30.3	22.36
Total area	135.5	100	135.5	100	135.5	100	135.5	100

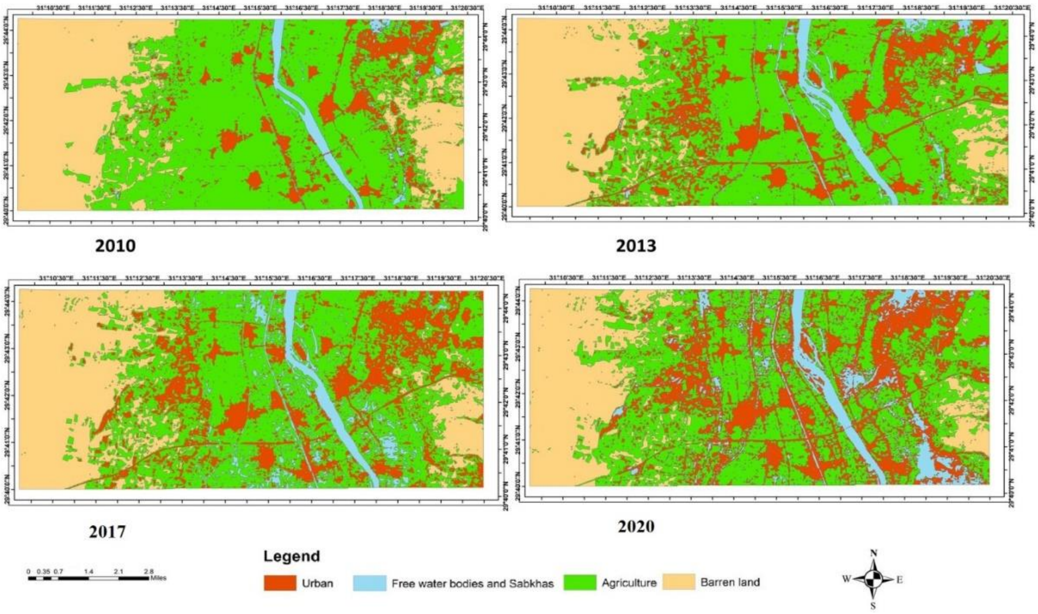


Fig. 4. Land cover maps for study area in 2010, 2013,2017 and 2020.

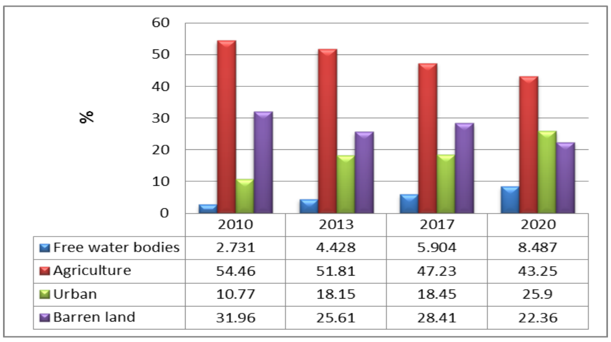


Fig. 5. Land cover percent as illustrated in column diagram .

The data in Table 6 show that during the study periods, there is a clear area decreasing trend for agricultural lands, while urban lands were constantly increasing ,generally at the expense of agricultural lands. In the same context, water bodies and sabkhas were increasing as a result of poor drainage. Barren lands are accordingly decreasing in expense to both water bodies and/or agricultural expansions. During the three last years, urban sprawl expanded The reason for that should be critically evaluated. The rate of change as illustrated in Figure 5 exceeded 200%.

Table 6 . Change detection between 2010 to 2020 years

Land Cover Type	2010-2013		2013-2017		2017-2020		2010-2020	
	Changed(km^2)	Rate (%)	Changed(km^2)	Rate(%)	Changed(km^2)	Rate(%)	Changed (km^2)	Rate (%)
Free water bodies and Sabkhas	2.3	86.5	2	33.3	3.5	43.8	7.8	210.8
Agriculture	-3.6	-4.9	-6.2	-8.9	-5.4	-8.4	-15.2	-20.6
Urban	10	68.5	0.4	1.6	10.1	40.4	20.5	225
Barren land	-8.6	-19.9	3.8	11	-8.2	-21.3	-13	-30.0

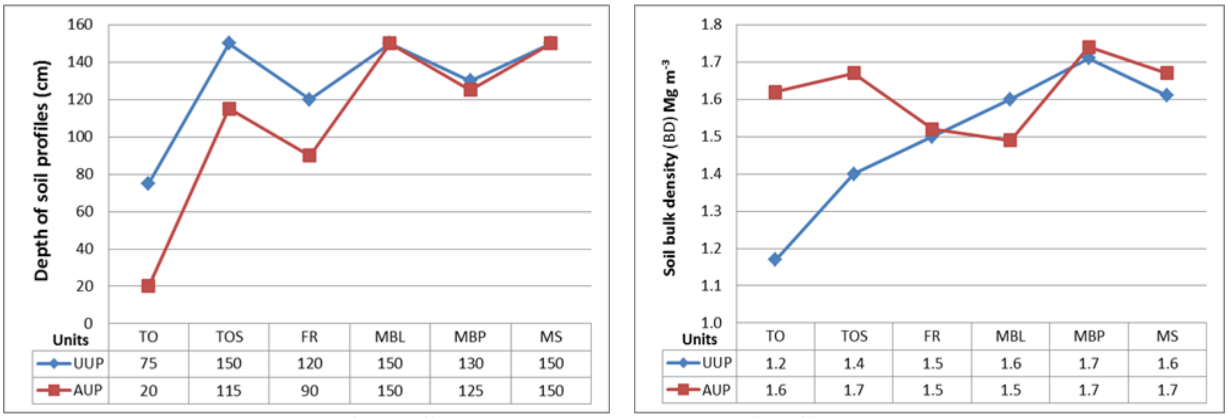
Through visual interpretation of the distribution of land cover within the studied intervals, it was found that there are three main patterns of urbanization; growth of urban agglomerations that already existed before near the road network, especially highways, and around waterways that are linked in one way or another to road networks.

Impact of Urbanization on soil

The locations of the studied soil profiles were designed in such a way as to allow following the impact of urbanization on agricultural land. Two soil profiles were studied for each land unit in the eastern side of the Nile River within the study area, one adjacent to the urban area and the other far from urbanization. After studying the characteristics of the two profiles in the field and making laboratory analysis of collected samples, the following characteristics were observed and evaluated (Tables 3 and 4 and Figures 6)

Most of the soil profiles affected by urbanization have a lower depth due to a rising water table compared to the unaffected soil profiles. This may be related to the impact of human activity and impeded drainage. In the same context, the bulk density was negatively affected in the soils influenced by urbanization.

This can be explained by the increase in the number of trucks passing over the soil or as a result of a decrease in organic matter that decomposes quickly due to the high atmospheric temperature. When comparing the rest of the properties in other profiles affected by urbanization with those unaffected in the study area, no clear degradation appeared except for the TO and TOS units in which salinity increased in the profiles affected by urbanization. Soil depth as referred to in this study is considered concerning water table at soil profiles.



UUP, soil profiles unaffected by urbanization; AUP, soil profiles affected by urbanization

Fig. 6. Changes in soil profile depth and soil bulk density, for different units.

With regard to the concentration of heavy metals, as in Table 7 and Figure 7, No relationship concerning pollution was found between the total and available contents, which is supported by the study of Abd Elgawad *et al.*, (2007) on the surface layer of the soil of Fayoum District of Fayoum Governorate. Available heavy metals did not exceed the maximum permissible limits according to USEPA (1997), WHO/FAO (2007), and European Union (2002). These results could be supported with the studies of El Azab, H. E., *et al.*, (2015) who studied the status of heavy metals in the vicinity of the study area.

Table 7 . Total and available content of heavy metals in the soil

Units	Profile NO.	Pb (mg Kg^{-1}) A	Pb T	Ni (mg Kg^{-1}) A	Ni T	Cd (mg Kg^{-1}) A	Cd T	Co (mg Kg^{-1}) A	Co T
TO	1	1.556	4.050	0.758	16.25	0.150	9.500	0.108	2.950
	2	1.902	4.400	0.572	13.65	0.730	13.500	0.172	0.500
TOS	3	1.272	6.300	0.100	9.300	0.486	5.000	0.114	0.450
	4	1.790	8.200	0.020	4.950	0.696	7.150	ND	ND
FR	5	0.888	7.350	0.056	63.800	0.630	4.700	0.112	16.850
	6	1.136	9.100	0.318	64.250	0.240	3.800	ND	11.750
MBL	7	1.766	6.500	0.552	71.700	0.138	11.150	0.114	16.150
	8	0.516	6.500	0.250	68.350	0.926	8.300	ND	11.050
MBP	9	0.128	5.350	0.202	58.600	0.708	16.450	0.080	12.900
	10	1.828	8.700	0.278	62.100	0.790	2.250	ND	12.250
MS	11	0.796	4.200	0.422	44.000	0.484	8.000	ND	5.350
	12	1.110	10.150	0.168	46.300	0.520	7.150	ND	11.600

A, Available; T, Total; ND, Non-Determined

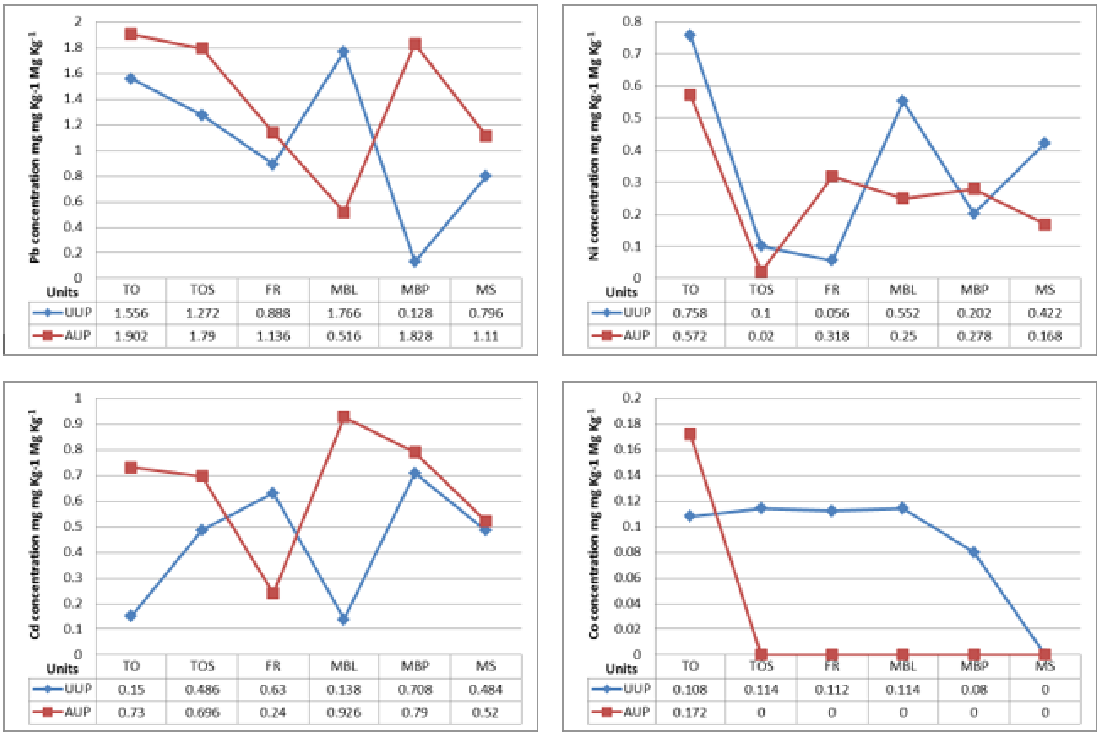


Fig. 7. Changes in heavy metal concentrations in soils of the different geomorphological units.

The distribution of heavy metals, in general, and especially the total content, can be related to differences in parent material in every geomorphic unit.

Except for available cobalt content in the five studied units affected by urbanization, the values were higher than those of the unaffected. Contrary to this, the MBL unit, where available content was 1.766 $mgkg^{-1}$ in the unaffected soil compared to 0.516 $mgkg^{-1}$of the affected one.

The concentration values differed in the MPL unit, concerning the available lead and nickel where they are higher in the unaffected soils than in the affected.

The lead increased from 0.516to1.766 $mgkg^{-1}$ and nickel from 0.250 to 0.552 $mgkg^{-1}$, which are attributed to the proximity of the profile to a highway.

In general, values of available heavy metals conform with the total content however, some irregular values were also detected.

Available lead content in the FR unit as noticed was 0.630 mg/kg in the affected profile compared to 0.240 mg/kg in the unaffected profile, which may be attributed to nearby heavy traffic. Wastewater and sewage are occasionally or permanently used in irrigation. Also, the TO unit followed a similar trend explained to the same reason.

According to Marcotullio *et al.* (2008), the concentration of cobalt generally shows low levels, close to those reported in uncontaminated soils, and its total concentration is often related to the type of parent material.

The results showed that soil contamination with heavy metals in the study area influenced by urbanization is due to two factors; the first and the most influential is the proximity to roads, where the concentrations of cadmium and lead in soil samples increased with the approach to heavy traffic. The second factor is the effect of industrial wastewater and sewage used in irrigation water.

Although the concentration of heavy metals in the soil is within the safe limits, most of the soil profiles close to urbanization recorded values of heavy metals relatively higher than the values of profiles in agricultural lands in the same physiographic unit. On the contrary, some profiles in agricultural lands have recorded higher values than those close to urbanization; the reason for this can be attributed in general to the extent of the proximity of distance from traffic roads.

For these reasons, although the concentration of heavy metals in the soil is within safe limits, the rate of concentration is most important than the content, as with time it can reach critical limits.

CONCLUSION

The current study aimed at assessing the expansion of urbanization at the expense of other types of land cover especially, the cultivated lands because of the scarcity of the highly fertile Nile cultivated lands. The objective of the study was facilitated by processing and classifying satellite images of four successive periods (2010, 2013, 2017, and 2020). The properties of soils affected by urbanization and those unaffected were compared in each geomorphological unit. According to the methodology used in this research, the results obtained indicated that water bodies and urban areas increased. The decrease of the Nile soil is effectively serious as they are highly capable of agricultural production.

Symptoms of salinization are also noticed due to ineffective drainage. Therefore, it is highly recommended to issue laws regulating urbanization that ensure the preservation of the area of agricultural land from loss. Taking all measures that ensure the preservation and improving the fertility of agricultural lands. in order to maintain the natural equilibrium of the ecosystem is highly recommended.

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تأثير التوسع العمراني على بيئة التربة جنوب محافظة الجيزة ، مصر.

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تهدف الدراسة الحالية إلى الرصد الكمي لتغير استخدامات الأراضي وأثره على الخواص الفيزيائية والكيميائية للتربة وتركيز الملوثات جنوب الجيزة .تم تمثيل الوحدات الجيومرفولوجية بمنطقة الدراسة من خلال اثني عشر قطاعًا للتربة ، حيث تم تمثيل كل وحدة جيومرفولوجية بقطاعين, احدهما متأثر بالزحف العمراني والثاني غير متأثر. تم جمع عينات التربة حسب التباين المورفولوجي بالقطاع وتحليلها لتحديد الخواص الفيزيائية والكيميائية. تم معالجة وتصنيف صور الأقمار الصناعية لأربع فترات متتالية (٢٠١٠ ، ٢٠١٣ ، ٢٠١٧ ، و ٢٠٢٠) ، لتقدير التغير المكاني في الغطاء الأرضي. أشارت النتائج إلى وجود أربعة أنواع من الغطاء الأرضي في منطقة الدراسة ، المسطحات المائية ، الأراضي الزراعية ، التجمعات العمرانية ، والأراضي القاحلة. ازدادت المسطحات المائية بشكل تدريجي خلال فترة الدراسة من ٢,٧ إلى ٨,٥ بالمائة من منطقة الدراسة. وزادت المستوطنات الحضرية من ١٠,٨ إلى ٢٦٪ ، بينما انخفضت الأراضي الزراعية خلال فترة الدراسة من ٥٤,٤ إلى ٤٣٪. وانخفضت نسبة الأراضي القاحلة من ٣٢ إلى ٢٢,٤٪ على التوالي. تأثرت خصائص التربة بشكل كبير بالتوسع العمراني ، حيث زادت قيم الملوحة والكثافة الظاهرية ، وانخفض عمق التربة ، بالإضافة إلى الزيادة النسبية في المعادن الثقيلة مقارنة بالتربة الغير متأثرة. كشفت النتائج عن مؤشرات عالية الخطورة تتعلق بفقدان الأراضي الزراعية المنتجة ، واحتمال تجاوز الملوثات المستوى الحرج ، مما يهدد الأمن الغذائي والاستدامة ، وبالتالي احتمالية وجود مخاطر صحية على الإنسان والحيوان. ومن ثم ، يجب اتخاذ تدابير وقائية للحد من تلوث المعادن الثقيلة لمياه الري والتربة.