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Spatial Distribution of Soil Organic Carbon Pools in Soils from the Northeast Nile Delta, Egypt

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ABSTRACT

Soil Organic Carbon (SOC) is one of the important factors in crop production and plays a critical role in climate change as it affects soil characteristics and plant growth. So, thirty-four surface soil samples (0-30 cm) over the study area were collected to estimate the spatial distribution of carbon pools in soils from the Northeast Nile Delta, Egypt using Geographic Information Systems (GIS). The results indicated that the highest value of soil organic carbon (SOC) was 12.47 g kg^{-1} soil recorded in Eizbat Ashra location, while the lowest value was 3.73 g kg^{-1} soil registered in the New Damietta city location. Also, Geographical Information System (GIS) technique exhibited that the highest value of SOC occurred in the middle location, whereas the lowest content was observed in the north or south location. In addition, the highest value of soil carbon pool was 5.35 kg C m^{-2} occurred at Eizbat Ashra location, while the lowest value was 1.50 kg C m^{-2} recorded in New Damietta city location. Under the current study area, GIS technique exhibited that the soil C pool values were high in both middle and east locations, while these values decreased with a clear difference as we approached from the north, so the values became weak in the north of the study area. Also, the results exhibited the strong effect of soil properties change on organic carbon content over study areas. Finally, these findings monitoring carbon pools will provide decision makers with information on the conservation of soils from climatic changes impact along the Northeastern Nile Delta, Egypt.

INTRODUCTION

The Egyptian Nile Delta is one of the earliest delta systems in the world (El Banna and Frihy, 2009). it covers only about 2% of Egypt's land area but is home to about 41% of the country's population and about 63% of its agricultural land (Hereher, 2010) & (Mabrouk et al., 2013). One of the most often used indicators of soil quality is soil organic carbon (SOC) by enhancing the physical, chemical, and biological qualities in terrestrial ecosystems, it influences fertility and production. It is also important in anticipating climate change and its impacts (Krischbaum, 2000). SOC stability is determined by its resistance to microbial degradation and is associated with soil fertility and soil C sequestration ability (Leinweber et al., 2008).

Carbon dioxide (CO_2) concentrations in the atmosphere have increased globally by 47%, from 278 parts per million (ppm) in the preindustrial era to 409 ppm in 2017 (NOAA, 2017). Several cycles related to soil and plant systems, as well as plant productivity, soil quality, and environmental quality, are influenced by the climate, which is one of the major factors. the rate of CO2 increase in the atmosphere is caused by increased human activities.

Numerous factors including mineralization, decomposition, leaching, and loss of nutrients in the soil are influenced by changing climatic circumstances (such as temperature, CO_2, and precipitation) (Elbasiouny et al., 2022). Soil carbon pools are important for global climate change and carbon cycling since they are one of the largest carbon pools in the natural ecosystem (Lal, 2002), also around 75% of the entire C pool on the ground is found in soil so, the soil is essential for maintaining a balanced global carbon cycle (Shukla et al., 2017), where the soil's organic carbon (C) pool is higher than the total pools of biotic and atmospheric C (Batjes, 1996). slight changes in the SOC pool can have a significant impact on the global C cycle, affecting atmospheric GHG concentrations and global climate change (Smith, 2004). The soil carbon pool is the principal source of energy and nutrients for soil biota, and it drives biological activity (Powlsen et al., 2001). Labile and recalcitrant C pools are the two types of SOC pools the recalcitrant C pool has a longer turnover time and is more stable (Chen et al., 2016). The basic carbon pools include dead wood, litter, above and below ground biomass, In the top 1-m layer, global SOC stock is estimated to be around 1500×109 t this is more than double the amount in the atmosphere (Lefevre et al., 2017). Fast C pools include leaf and fine root biomass as well as the organic litter layers on top of the soil, whereas slow C pools include SOC in mineral soil and carbon in wood biomass (Norby et al., 2002). Climate (temperature and precipitation), soil qualities (particularly clay content), forest vegetation type (tree species), and stand history are significant site elements that affect how carbon is divided in pools with rapid or slow turnover (Huygens et al., 2005 and Muller & Koegel-Knabner, 2009).

Numerous variables, including soil type, climate, topography, crop management, and human factors, have an impact on the soil organic carbon pool (SOCP) (Abu-hashim et al., 2016), also the SOCP was impacted by conversion in agricultural systems by 50% in the top 20 cm of soil and by 25 to 30% in the top 100 cm of soil (Post and Kwon, 2000).

Forest soils store over 70% of the world's total soil organic carbon (SOC) (Jandl et al., 2007) while, around 37% of the world's terrestrial carbon pool are in Tropical forests (Schwenk, 1994).

Different soil characteristics, such as clay content, moisture level, aeration, soil depth, slope degree, and local aspects, control the development of soils as a reservoir for organic carbon (Silva et al., 2012) causing initial soil C loss accelerated decomposition, aggregate disruption, erosion, changes in soil microbial populations, changes in plant productivity, removal of plant biomass, changes in the chemistry and lability of crop plant inputs (Culman et al., 2010), also conversion from natural to agricultural ecosystems, tillage, and soil deterioration caused by erosion and other processes, the world's soils have lost 55 to 90 Pg of carbon (Lal, 2004), as well land use, soil texture, and drainage were the major factors influencing SOCP at 30 cm depth of the soil surface (Tan et al., 2004). whereas regular and ongoing fertilizer application raises SOC content (Kundu et al., 2007).

Data from remote sensing satellites are now a keyway to monitoring carbon emissions. Remote sensing.

data is becoming more important for carbon monitoring and fixation because of its distinctive qualities including availability, high resolution and vast coverage (Chen et al., 2021). The present study aims to determine the organic carbon concentration in soil, carbon pools and its relationship of the factors such as soil texture, bulk density and values of nutrients in it.

MATERIAL AND METHODS

Study area

The study area is located to the Northeast of the Nile Delta between longitude 31º40\` & 32º 05\` E and latitudes 31º 02\` & 31º 32\` N (Figure 1). It occupies an area of 1107 km2 (i.e., 264000 Feddans) most of which are agricultural lands, while the rest include utilities, barren land, lakes & ponds and urban areas. According to Egyptian Meteorological Authority (1996), and the USDA soil taxonomy (2010), Thermic and Torric soil regimes exist; this indicates that the area is mainly affected by arid climate.

Field work and soil sampling analyses:

Field visits were conducted to 34 sites representing the main landforms in the area as shown in Figure 2. Interviews were done with farmers to observe the yield, and crucial obstacles during the seasons. The investigated sites were determined using a GPS to link them with Landsat-8 data. Soil profiles were dug and described using FAO (2006) to represent the different soils. Soil samples were reserved and prepared for lab analyses using USDA (2004).

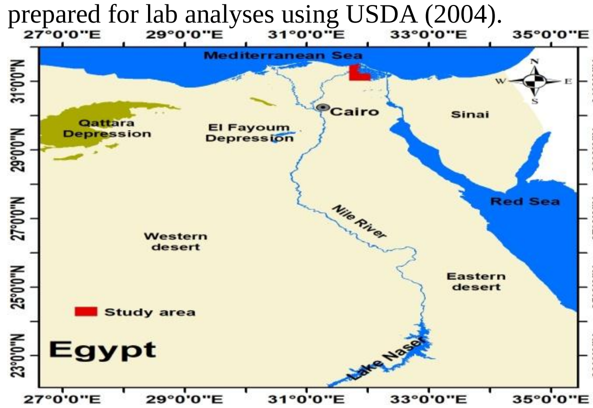
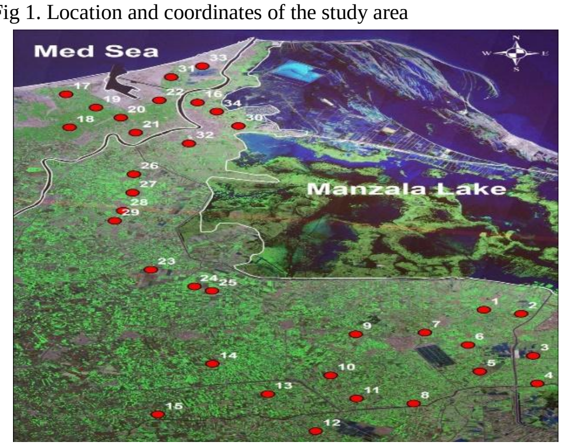


Fig 1. Location and coordinates of the study area



The particle size distribution was estimated using the standardized pipette method. according to the international method to (Piper, 1950). soil reaction (pH) values were measured in the soil water suspensions, (1:2.5) according to Jackson (2005). Electrical conductivity EC, (dSm^{-1}) was determined in 1:2.5 soil water extract by using electrical conductivity bridge according to Jackson (1967).

Total carbonate percent $CaCO_3$ using Collin's Calcimeter Piper (2017). Determinations of calcium (Ca^{+2}) and magnesium (Mg^{+2}) were made using aversenate solution. Eriochromc black T was used as an indicator for (Ca^{+2}, Mg^{+2}) while ammonium purpurate was used as an indicator for Ca^{+2} (Jackson, 1973). Available nitrogen was assessed in the soil extracted using K_2SO_4 and assessed with macro-Kjeldahl according to Hesse (1971).

Sodium bicarbonate was used to extract the available phosphorus, which was then measured calorimetrically. according to Olsen and Dean (1965). Available potassium was extracted using ammonium acetate and then measured by a flame photometer according to Jackson (1967).

Total nitrogen was determined in digested soil samples by using macro-Kjeldahl according to (Hesse, 1971).

The bulk density SBD of the soil samples was estimated, each sample was dried for 3 days at 105°C in an oven, then placed in a desiccator to cool to room temperature before being weighed. The computation is carried out using the equation by (Sahu et al., 2019). The soil organic carbon (SOC) of each sample was evaluated in the laboratory using the wet digestion method (Walkley and Black 1934). Then the soil organic carbon (SOC) concentration was estimated as:

$$SOC = (g\ C\ kg^{-1}) = 0.58 \times SOM\ (g\ C\ kg^{-1}). \qquad (1)$$

Where, SOC is soil organic carbon content for soil samples, SOM is soil organic matter values of soil samples.

The SOC density was calculated using the subsequent equation (kg C m^{-3}) (Han et al., 2010):

$$SOC_{density} = \text{Bulk density } (g\ cm^{-3}) \times SOC \qquad (2)$$

Finally, the soil organic carbon pool SOCP was calculated based on the following equation:

$$\text{Carbon Pool } (kg\ C\ m^{-2}) = \text{bulk density } (g\ cm^{-3}) \times \text{depth } (cm) \times SOC \qquad (3)$$

Spatial analyses

Spatial distribution of soil organic carbon (SOC) and carbon pools (SOCP) was done using the Inverse Distance Weight (IDW) model. This method weighs the values of measured sites to derive estimations for an unmeasured location. The measured values closest to the prediction location have more influence on the predicted value than those further away, thus giving greater weight to points closest to the prediction location, and the weights decrease as a function of distance. Inverse Distance Weight (IDW) of Arc-GIS 9.2 software has been used to interpolate the soil properties (SOC, SOCP) consequently thematic maps of soil organic carbon and carbon pools were produced.

Statistical data analysis

Descriptive statistics for each of the studied soil samples were obtained using the Statistical Package for the Social Sciences (SPSS) (version 23.0). Also, a principal component analysis (PCA) was performed on the logarithmically transformed data using factor extraction. The Eigenvalue remained greater than 1 after varimax rotation.

RESULTS AND DISCUSSION

Soil samples at depth of (0-30) cm were taken from many locations to determine soil bulk density (SBD), soil organic carbon concentration (SOC), SOC density and carbon pools of studied areas. Table 1 demonstrates descriptive statistics and the range of variations for the studied soil samples (clay, sand, silt, soil salinity, soil reaction, cations exchange capacity, total nitrogen TN, calcium carbonates percent and organic matter content), while Table 2 showed dissolved organic carbon (mg kg^{-1} soil), oxidizable organic carbon content OOC (mg kg^{-1}), soil bulk density SBD (g cm^{-3}), soil organic carbon SOC (g C kg^{-1} soil), and C pool content (Kg C m^{-2}) of soil samples in studied locations.

Characteristics of soil under study:

Soil texture controls soil quality and productivity as well as its role in soil degradation and water transport. For Table 1, the descriptive statistics for the studied soil properties revealed that there is a variety of soil samples texture in the area under study between each of the following types of soil texture; Silt Loam-Silt-Loam-Sandy Loam-Loamy Sand-Sand.

Table 1. Descriptive statistics for the physical and chemical properties of studied soil samples.

Characters	Range	Mean	Std. Error	Std. Deviation	Variance	Skewn.	Kurt.
Particle distribution size (%)							
Sand	5-95	42.79	4.21	24.56	603.32	0.806	o.364-
Clay	5-20	8.67	0.74	4.32	18.65	1.158	0.954
Silt	0-90	48.52	4.12	24.04	578.08	0.624-	0.517-
Chemical estimations							
pH	8-9	8.12	0.06	0.33	0.11	2.484	4.430
EC (dSm^{-1})	0.18-3.65	0.96	0.15	0.87	0.75	2.193	4.584
$CaCO_3$ (%)	0 - 6	3.85	0.26	1.54	2.37	0.479-	0.729-
TN (mg kg^{-1} soil)	1000 - 3000	2100	0.10	0.52	0.03	0.19-	0.570-
CEC (Cmol kg^{-1})	21.06-63.62	41.06	2.39	13.92	193.79	0.008	1.325-
OM (g kg^{-1} soil)	6.43-21.50	13.27	0.71	4.14	17.14	0.392	0.332-
C/N Ratio	17.81-66.32	38.87	2.25	13.13	172.31	0.538	0.565-

Significant: Skewn. is significant if skewness is divided by the standard error of skewness > 2.

The values of soil salinity (EC) for the samples in the study area ranged from 3.65 to 0.18 dSm^{-1}, with a mean value of 0.96 dSm^{-1}. The increase in soil salinity may be caused by poor drainage, poor quality irrigation, increasing the soil content of clay and silt, increasing the groundwater levels and wrong treatments on the soil as a fertilization error or neglecting agricultural service operations. While a decrease in soil salinity for some soil samples in the study area may be attributed to increasing the soil's sand content while lowering its clay content and rising groundwater levels.

In most of the studied soil samples, the soil reaction values were alkaline where, pH values in the study area varied between 8.61 and 7.85 with a mean value of 8.12. under the present study, data reported that the values of calcium carbonate ($CaCO_3$) of the study samples ranged between 0 to 6.4%. with the mean value of 3.85%. This might be attributed to the soil's clay content, due to the relationship between soil clay content and calcium carbonate rates. Soil texture and $CaCO_3$ content are crucial in regulating soil quality and production, land degradation, and water transport mechanisms this is according to (**Curcio et al., 2013 and Mitran et al., 2019**). Several factors affect the total amount of nitrogen in the soil, including soil texture, and this agrees with (**Zhu et al., 2009 and Armstrong et al., 2009**). The clay texture of the soil makes it have a high total nitrogen content, in contrast to the sandy texture which it ranged between 1000 mg kg^{-1} soil with mean value of 2100 mg kg^{-1} soil of the studied area.

The cation exchangeable capacity ranged from 21.06 to 63.62 with a mean value of 41.06 ± 2.39 cmol kg^{-1} among the various studied locations. Also, organic matter content ranged between 6.43 to 21.50 g kg^{-1} soil in soil samples of the studied area with mean value of 13.27, with Eizbat Ashra location which had the maximum value whereas, the minimum value was recorded in New Damietta city location. Furthermore, C/N ratio varied between 17.81 to 66.32 with the mean value of 38.87 ± 2.25 in the studied area.

Soil organic carbon fractions: -

Under the current study, Table 2 revealed that the dissolved organic carbon (DOC) varied between 873 to 190 mg kg^{-1} soil with a mean value of 468.44 ± 24.87 mg kg^{-1}.

Kurt. is significant if kurtosis is divided by standard error of kurtosis < 2.

Table 2. Descriptive statistics for soil bulk density, SOC (g kg^{-1} soil), dissolved organic carbon, OOC (mg kg^{-1}), SOC density (kg C m^{-3}) and C pool content (Kg C m^{-2}) of studied locations

Characters	Range	Mean	Std. Error	Std. Deviation	Variance	Skewn.	Kurt.
DOC (mg kg^{-1} soil)	190.50-873	468.44	24.87	145.03	210.20	0.682	0.461
OOC (mg kg^{-1} soil)	148.4-831.14	542.69	33.76	196.87	387	0.009-	1.472-
BD (g cm^{-3})	1.14-1.49	1.36	0.02	0.089	0.01	0.755-	0.003-
SOC (g kg^{-1} soil)	3.73-12.47	7.69	0.41	2.401	5.76	0.392	0.332-
SOC density (kg Cm^{-3})	5.00-17.82	10.44	0.58	3.38	11.43	0.648	-.016-
C Pools (kg Cm^{-2})	1.50-5.35	3.13	0.173	1.014	1.03	0.648	0.016-

BD; bulk density, SOC; soil organic carbon, DOC; dissolved organic carbon, OOC; oxidizable organic carbon, SOC density; soil organic carbon, C pools; carbon pools

The highest value of DOC was registered in Ezbet Al-Basaila location (31° 58' 22.7" E and 31° 09' 0 9" N), while the lowest value was recorded in Ezbet Abu Tawila location (31° 58' 16.1" E and 31° 0 9' 05" N).

It could be noticed that differences in soil dissolved organic carbon content in selected soil sampling under the current study may be attributed to several factors: soil reaction (alkalinity or acidity), nutrient availability also mobility, microbial activity and effect on the bioavailability of trace elements **(Thurman, 1985)**.

On the other hand, the oxidizable organic carbon (OOC) values ranged from 831 to 148 mg kg^{-1} soil with the mean value of 542.23 ± 33.76 mg kg^{-1} soil. The highest value occurred with Ezbet El-Burj location (31° 48' 42.1" E and 31° 26' 34" N), while the lowest value was in Ezbet El-Gabayza location, Port Said (31° 48' 42.1" E and 31° 26' 34" N).

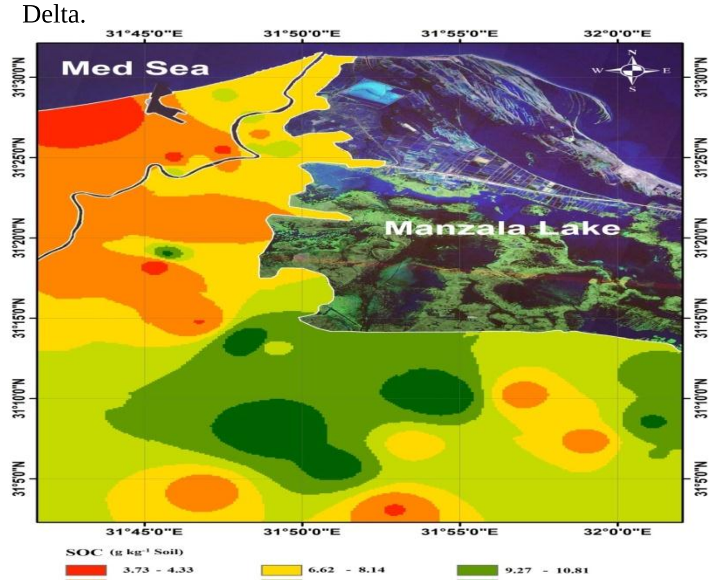
Spatial distribution of soil organic carbon and soil organic carbon pool: -

Models that predict soil processes frequently require measurements of the bulk density of the soil as an input parameter (**Heuscher et al., 2005**). As illustrated in Table 2, there is a difference in bulk density values of soil samples ranged between 1.14 to 1.49 g cm^{-3} with the mean value of 1.36 g cm^{-3} in the current study.

The value of the bulk density in the soil is influenced by many factors such as the proportion of pores, the depth, the soil's texture, the amount of organic matter and the agricultural practices. The highest mean value of the bulk density was recorded in New Damietta location, whereas, the lowest value of the bulk density was registered in the Al-Sawahil Village location. This may be attributed to it containing a high percentage of organic matter (**Chaudhari et al., 2013**). The highest value of bulk density showed that soil samples with sandy texture due to the volume of pores in these soils such as in areas of Al-Ladamin Village and Eizbat Al-Najaarin. According to **Sakin et al., (2011),** low porosity, high sand content, and low organic matter content integrated soils with a high bulk density. Regularly, it supplies both porosity and water retention of soil (**Huang, 2015**) and donates the distribution of sediment organic contents (**Johnston et al., 2004**).

Overall, organic carbon in the soil is one of the fundamental components of soil and an important metric for determining its quality **(Doran et al., 1998).** So, the soil quality such as chemical, physical and biological properties is mainly affected by the contents of organic carbon in the soil **(Sinoga et al., 2012).**

Table 2 and Fig 3 point out the spatial distribution of SOC content in the selected soils along the Northeast Nile Delta.



3. The spatial distribution of soil organic carbon under the study area

The obtained results in Table 2 revealed that values of soil organic carbon varied between 3.73-12.47 g kg^{-1} soil with a mean value of 7.69 ± 2.40 g kg^{-1} soil. The highest value of soil organic carbon (SOC) was recorded in Eizbat Ashra site, while the lowest value was registered in New Damietta city site. The soil organic carbon (SOC) conservation in soil is based on a balance between carbon input from production and carbon output from carbon decay (**Trumbore and Harden, 1997**). By using Geographical Information System (GIS), Fig 3 indicated that the spatial distribution of soil organic carbon (SOC) in the study area which the highest value of soil organic carbon is found in the middle location, whereas the lowest content of soil organic carbon is found in the north or south location. Overall, SOC values are affected by soil texture, porosity, CEC, nutrients availability, aggregate stability and microbial activity (**Liao et al., 2015; Bationo et al., 2007 and Gosain et al., 2015**). Also, climate, soil texture, vegetation, topography, drainage, and land management have an impact on SOC (**Homann et al., 1995**).

In the present study, soil organic carbon density values ranged from 2.07 to 17.83 kg cm^{-3} with mean value of 10.44 ± 2.40g kg^{-1} soil for soil sample studied area. The differences in SOC density can be associated with the physical and chemical sediment properties including pH, SBD, soil type and mineral elements, or the effect of microclimate, biological activity, decay and primary productivity (**Mcleod et al., 2011 and Zhan et al., 2013**).

In addition, Table 2 and Fig. 4 demonstrate the spatial distribution of carbon pool values registered in soils from the Northeast Nile Delta, Egypt.

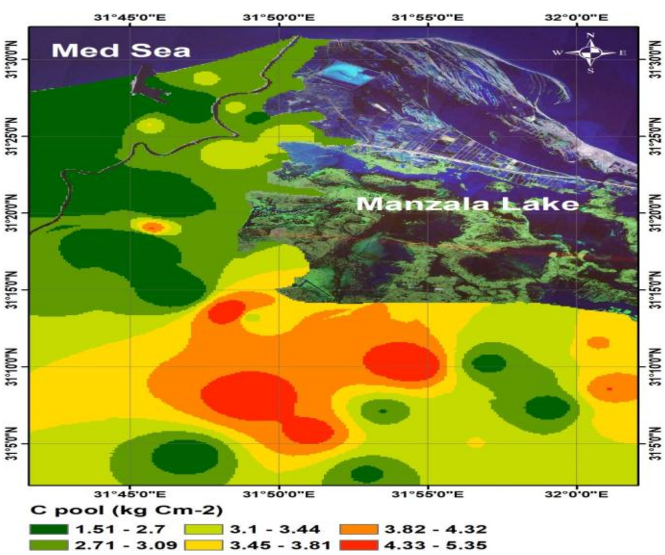


Fig ٤. The spatial distribution of carbon pools under the study area

The observed results in Table 2 showed that the values flocculated from 1.50 to 5.35 kg C m^{-2} with the mean value of 3.1 3± 0.173. The highest value was 5.35 kg C m^{-2} occurred at Eizbat Ashra location, while the lowest value was 1.50 kg C m^{-2} recorded in New Damietta city location.

Moreover, Fig 4 exhibited that the C pool values were high in the middle and east locations, while these values decreased with a clear difference as we approached from the north, so the values became weak in the north of the study area.

Principal component analysis (PCA):

To evaluate the soil carbon pool in soils under the current study, we used varimax rotated principal component analysis (PCA) and valued Eigenvalues. Ultimately, as illustrated in Table 3, significance is taken in consideration when loadings appeared more than 0.60. The varimax rotated principal component analysis included eight factors that accounted for 92.46% of all computerized data.

Table 3: Varimax rotated principal component analysis (PCA) of measured biomass parameters and soil samples (bold loadings are statistically significant).

Investigated Variables	PCA1	PCA2	PCA3	PCA4	PCA5	PCA6	PCA7	PCA8
SOC (g kg^{-1} soil)	**0.988**							
C pools (kg C m^{-2})	**0.987**			0.106				
SOC density	**0.987**			0.106				
C: N Ratio	**0.847**	-0.148-	-0.479-					
Silt%		**0.958**		-0.129-	0.112			-0.104-
Sand%	0.102	-0.955-		0.148	-0.104-			
T N (g kg^{-1} soil)		0.121	**0.932**	-0.134-		-0.100-		
pH		-0.123-	-0.365-	**0.778**			-0.147-	-0.103-
BD (g cm^{-3})	0.136	-0.175-		**0.746**	-0.288-	0.193	-0.160-	
OOC (mg kg^{-1} soil)		0.438			**0.801**	-0.107-		
CEC (cmol g^{-1})	0.176	-0.117-	0.520	-0.191-	**0.664**		0.224	
DOC (mg kg^{-1} soil)			-0.153-	0.304		**0.857**	0.157	-0.139-
$CaCO_3$%		0.505		0.204	0.118	-0.614-	0.454	
Ec dSm^{-1}	0.110			-0.262-			**0.910**	
Clay %						-0.108-		**0.985**
Eigenvalue	4.877	3.362	1.759	1.287	1.132	0.918	0.781	0.678
Variance %	30.478	21.014	10.991	8.044	7.076	5.741	4.882	4.236
Cumulative %	30.478	51.492	62.483	70.53	77.603	83.343	88.226	92.461

Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization

The 1st major factor characterized 30.47 % of the total variance with an eigenvalue of 4.87 and this factor illustrated a considerable load to only soil organic carbon in the studied soil. The 2nd factor (21.01 % of the total variance with an eigenvalue = 3.36) showed substantial loading on the silt fraction (%) in studied soil. Likewise, the 3rd component amounted to 10.99% of the total variance with an eigenvalue = 1.76 and this factor gave a significant load of 0.93 on total nitrogen in soil. Ultimately, the 4th factor accounted for about 8.04% of the total variance, with an eigenvalue of 1.29, and offered load soil reaction and bulk dens (m]). Factor 5 exhibits 7.08 % of the total variance with positive loadings of 0.80 and 0.66 on oxidized organic carbon (mg and cations exchangeable capacity, respectively. While the 6th factor displays 5.74% of the total variance with positive loading of 0.857 on dissolved organic carbon (mg kg^{-1} soil) with an eigenvalue of 0.92. The 7th factor accounted for about 4.882% of the total variance positive loading of 0.91 and with an eigenvalue of 0.78 on EC dSm^{-1}. Finally, the 8th component offered a significant loading of 0.99 on clay fraction (%) with a total variance of 4.24% and an eigenvalue of 0.68.

CONCLUSION

Generally, it can be concluded that there are significant variations of soil organic carbon pool (SOCP) among different soil textures and land uses. Soil with high clay content revealed an increase in the value of soil organic carbon. Under the current study, Geographical Information System (GIS) technique exhibited that the highest value of SOC was found in the middle location, whereas the lowest content was observed in the north or south location. Also, the highest value of soil organic carbon (SOC) was 12.47 g kg^{-1} soil recorded in Eizbat Ashra location, while the lowest value was 3.73 g kg^{-1} soil registered in New Damietta city location. In addition, the highest value of soil carbon pool was 1.50 kg C m^{-2} occurred with Eizbat Ashra location, while the lowest value was 1.50 kg C m^{-2} recorded in New Damietta city location. Under the current study area, GIS technique exhibited that the soil C pool values were high in both middle and east locations, while these values decreased with a clear difference as we approached from the north, so the values became weak in the north of the study area. Finally, unfortunate human activities have significantly altered carbon capture and increased emissions into the atmosphere and this alteration is supported by maps with laboratory analyzes.

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CONFLICT OF INTEREST:

The authors declare that they have no conflict of interest.

AUTHORS CONTRIBUTION

El-Metwally M. Selim; Ali, R. R.; Aya M. El-Ghareeb and Soliman A. Mohamad developed the concept of the manuscript. All authors checked and confirmed the final revised manuscript.

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التوزيع المكاني لمخزون الكربون العضوي للتربة في أراضي شمال شرق دلتا النيل، مصر

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الملخص العربي

يعتبر الكربون العضوي للتربة (SOC) هو أحد العوامل المهمة في إنتاج المحاصيل ويلعب دورًا مهمًا في تغير المناخ لأنه يؤثر على خصائص التربة ونمو النبات. لذلك، تم جمع ٣٤ عينة من التربة السطحية (٠-٣٠ سم) من منطقة الدراسة لتقييم التوزيع المكاني لخزن الكربون أراضي شمال شرق دلتا النيل، مصر باستخدام نظم المعلومات الجغرافية (GIS). أشارت النتائج إلى أن أعلى قيمة للكربون العضوي للتربة سجلت في موقع عزبة عشرة ١٢.٤٧ جم / كجم بينما كانت أقل قيمة ٣.٧٣ جم/كجم لتربة بموقع مدينة دمياط الجديدة. كما أظهرت تقنية نظام المعلومات الجغرافية (GIS) أن أعلى قيمة لـ SOC حدثت في الموقع الأوسط، بينما لوحظ أقل محتوى في الموقع الشمالي أو الجنوبي. بالإضافة إلى ذلك، كانت أعلى قيمة لمجمع كربون التربة 5.35 كجم/م ^{٢} في موقع عزبة عشرة، بينما سجلت أقل قيمة ١.٥٠ كجم/ م ^{٢} في موقع مدينة دمياط الجديدة.

تحت ظروف منطقة الدراسة الحالية، أظهرت تقنية GIS أن قيم تجمع الكربون العضوي بالتربة كانت عالية في كلا من الموقعين الأوسط والشرقي، بينما انخفضت هذه القيم بدرجة كبيرة كلما اقتربنا من الشمال حتى أصبحت القيم ضعيفة في شمال منطقة الدراسة. كما أظهرت النتائج التأثير القوي لتغير خصائص التربة على محتوى الكربون العضوي في مناطق الدراسة. وأخيراً، ستزود نتائج رصد خزن الكربون في التربة صانعي القرار بالمعلومات حول الحفاظ على هذه الأراضي من أثر التغيرات المناخية على طول شمال شرق دلتا النيل، مصر.