Classification of soils affected by salt accumulation west of Shatt Al-Arab at Basra Governorate

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Abstract

This study was conducted in the southern part of the alluvial plain, located within the administrative borders of Basra Governorate, confined between the Shatt Al-Arab to the east and the tidal flats (Spawn) to the west, between longitudes (-48.00°, -48.30°) east, and latitudes (-30.05°, -30.30°) north. Aimed to study of the impact of storming into salty marine waters, and its impact on the salinization of the lands adjacent to Shatt Al-Arab. About 2091 km^2 The total area of the study area was estimated, to study some morphological, physical and chemical properties of soils. Study of the hydrochemical characteristics of groundwater in the study area. The extent to which this water and soil are affected by salinity coming from marine waters, during the tidal phase, which originates from Shatt Al-Arab stream and the Khor Al-Zubair channel, based on field work. The study area was deducted using Geographic Information A number of processing operations were carried out on it, including filling in gaps, correcting and making arc map corrections, which were corrected and converted into a digital image, then separated them into five categories based on the salt evidence. Spectral evidence relevant to the research topic Erdas 8.4 salt was calculated. The soil units were separated based on the salt index types. As typical and representative sites for soil pedons, five locations on Earth were selected using a GPS Global Positioning System.

Keywords: *Soils, salt tides, Shatt Al-Arab, Basra Governorate.*

Introduction

Sedimentary soils in Basra Governorate are distributed in secondary physiographic units, among them are river shoulder units with a mixed clay-silty texture, and river basin units, include high basin and low basin depression, located around rivers after river shoulders, at the southern part of the alluvial plain, the other part is Spawn soil, through which the upper tidal flats of the creeks linked to Khor Al-Zubair and Khor Abdullah extend to the west, it faces from the eastern side the tidal-textured soils adjacent to the Shatt al-Arab course and the lands adjacent to it [3], [4].

Spawn soils are generally characterized by their soft texture and close to the water level, exposure to direct immersion in marine water and rainwater collection, as well as marine

filtration (seepage), from the waters of the Gulf or Shatt al-Arab, which is greatly affected by sea level, the tidal system, and the difference between them [6].

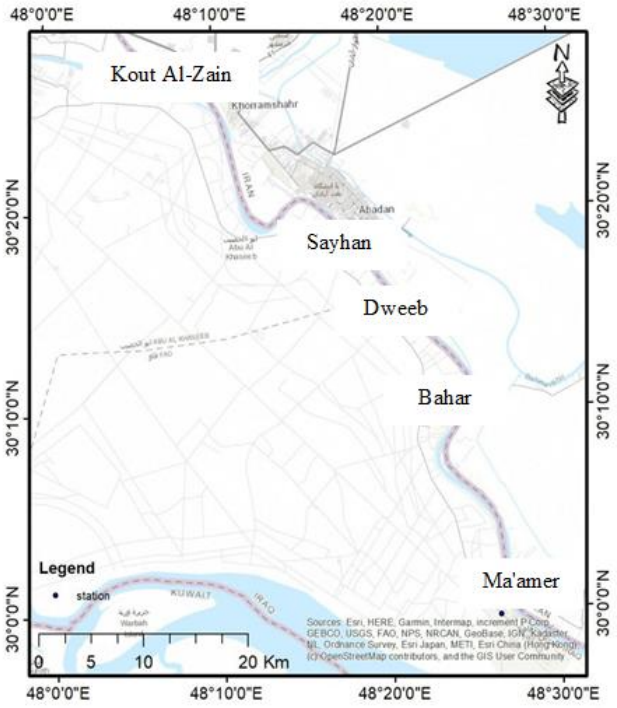
Due to significant changes in water levels entering Shatt Al-Arab, from the Tigris and Euphrates rivers and Khor Al-Zubair from the general estuary, led to an advance in the salt tidal front in the water columns of the two channels, some of them exceeded the administrative borders of the city of Basra in the north[5].

Which directly affected the aquatic and agricultural environment and other aspects of urban, urban and industrial life, since the hydrological system of the tidal flats surrounding both channels is affected by the water level at low tide, because tidal surges and the speed of their progress, it varies between Shatt Al-Arab course, Khor Abdullah channel, and then Khor Al-Zubair [7].

Because there are clear differences in the cross-section of each of them at the mouth or the rest of the canal parts, in addition to the rivers associated with each of them, as well as the disparity between the displacement and distance in each of Khor Abdullah and Khor Al-Zubair channels, it will have an impact on the nature of the movement of ground water associated with or affected by the surface water of the two channels in the soil adjacent to each of them, so the aim of the study is to classifying the soils in the study area and knowing the extent to which their properties are affected by salt tides, and identifying the sources of soil salinization, whether from river branches or direct marine sources during tidal surge.

Study area location:

The study area is located within the administrative boundaries of Basra Governorate, starting from the north of Al-Faw District until the southern parts of Siba District, it is bordered to the east by Shatt Al-Arab River and to the west by modern deposits, located in the southern parts of Iraq between longitudes (-48.00°, -48.30°) east, and two latitudes (-30.05°, - 30.30°) north, it represents Shatt Al-Arab Valley, and the area of the area is about (2091 km^2), shown in Map (1) and Table (1) of the coordinates of the pedons of the study area.



Map (1) Selected study areas of Shatt Al-Arab.

Table (1) Coordinates of the pedons of the study area.

Pedons No.	Pedons Name	Longitudes	Latitudes
1	Kout Al-Zain	48° 3' 54.1"	30° 26' 12"
2	Sayhan	48° 15' 29.6"	30° 18' 22.5"
3	Dweeb	48° 19' 55.5"	30° 15' 0.4"
4	Bahar	48° 23' 8.9"	30° 10' 11.9"
5	Ma'amer	48° 25' 31.4"	30° 2' 11.5"

Geology of the study area:

The study area is located south of the city of Basra, astronomically, between longitudes (-48.00°, -48.30°) east and latitudes (-30.05°, -30.30°) north. Shatt Al-Arab Valley represents a river valley that takes a north-west, south-east direction, many secondary rivers and streams branch off from it on both its eastern and western banks. The region is geographically defined by the southeastern part of Basra and the northern part of the Arabian Gulf. It is part of the southern Shatt Al-Arab basin. The Shatt al-Arab stream represents the eastern part of Basra Governorate, represented in a flat area of the alluvial plain in the northern part of the Arabian Gulf. Shatt Al-Arab region is located within the major geographic unit of the Mesopotamian Plain, they are low-altitude plains adjacent to the main rivers, after their withdrawal, the largest part of which is formed by sediments left by the sea, it was formed from the sediments[14] of the delta of the Tigris and Euphrates rivers, which advanced southward to its positions at Al-

Qurna to form Shatt Al-Arab. Sedimentation processes continued through the Shatt al-Arab in the last part of the Shatt al-Arab until the end of the Mesopotamian Plain in this region, characterized by medium-fine textures, is of weak to moderate structure, and originates from transported sedimentary materials.

Classification of Iraqi sedimentary soils:

Many attempts have been made to diagnose and classify soils composed of sedimentary parent materials.[10] indicated the use of the old American genetic classification system to classify the soils of the Iraqi alluvial plain, diagnosed them as undeveloped soils belonging to the Azonal class and the Great Group Alluvial Soils.[8] used the modern system of soil classification, US-7th Approximation, on some soils of the alluvial plain, the existing soils were diagnosed on the basis of the river shoulder unit as falling within the great group of torrifluvents, while the soils within the river basin unit were identified as clay soils belonging to the Torrerts class, characterized by the characteristics of mud cracks, or some of them are characterized as Vertic Torrifluvents, classified under a supergroup under the order Entisols, does not have the typical characteristics of cracking [9], classified some soils of the Iraqi alluvial plain at the level of major soil groups, classified under the group of associated soil units of the Torrifluvents, Torrerts, and Salorthids, show that the soils of the Great Group Typic Torrifluvents are present in the river shoulders unit, as for the transitional areas between the river shoulders unit and the depressions unit, there are Vertic Torrifluvents soils, and Salorthids soils are found in the swampy areas (marsh areas).

[13] pointed out that there are some problems that affect the accuracy of determining the level of soil rank (order) in the modern American classification of alluvial plain soils, including the problem of the salic horizon in Aridisols soils and the change in organic matter content with depth in Entisols soils, each of them is capable of placing a new soil series in a different rank. .[11] classified some soils of the lower alluvial plain based on the modern American classification, it was suggested to add new taxa at the sub-group level for some soils, although it can be placed among the categories that already exist in the American classification.

Climate of the study area:

The region is located within the dry desert climate that characterizes the southern part of Iraq[11]. Table (2) shows the highest average temperature was in July (39) C° and the lowest average temperature was in January (14.8) C°, while the relative humidity was highest in December (76%) and lowest in July (18%), as for the total rainfall, the highest rate was in the month of March and amounted to (40.1) mm. No precipitation was recorded in the months of June, July, August and September. The highest average wind speed was in July and reached (3.6) m/s, and the lowest average was in November and reached (1.8) m/s, according to the data sources of the weather station for the city of Al-Faw (2019).

Soil classification:

The soils of the study area were classified according to the modern American classification[12], to the level of order, suborder, supergroup, subgroup, and family, and on the proposed classification for classifying Iraqi sedimentary soils, at the chain level by[2]. As all the pedons are characterized by having a recently formed calcareous sedimentary source material, it was transported by water and all of its studied soils fall within the Entisols order, because the main

characteristic of the soils of this class is the modernity of the evolutionary state due to the absence of earning horizons (B). It is the horizon of the accumulation of clay transported from the upper horizons, and it was noted that there is no transported clay, because the time factor is still not enough to form the gain horizon (B). In addition, all soils are located in the alluvial plain, which receives new deposits of sedimentary materials over repeated periods of time, helped to weaken pedogenic activity in these soils[10]. These soils were characterized by the presence of a weak Ochric surface horizon, characterized by light color with low organic matter content. The absence of other diagnostic horizons such as saline, calcic, petrocalcic, gypsic or petrogypsic horizons, with the dominance of the dry (torric) moisture system and the soil is not saturated within the first meter of the soil body.

As for the level of the suborder Fluvents, these soils consist of newly formed river deposits and are characterized by a stratified state, and most of them are transported and are derived from rocks, eroded soil, or river coasts. It is found in areas with a slope of less than 25% and is not susceptible to waterlogging within 50 cm of the soil surface, and its thermal regime is (hyperthermic) in which the temperature ranges more than 22 degrees Celsius. Free of rocky or semi-rocky layers within a depth of 25 cm from the soil surface, at the taxonomic level, the largest group falls within the group Torrifluvents, characterized by the presence of river deposits in a hot, dry climate and located under a moisture system of the Torric type. It is one of the soil moisture systems in which the soil is dry in all its parts for more than half the time while the soil temperature at a depth of 50 cm is more than 5 degrees Celsius. Humidity is not available for a period of more than 90 consecutive days when the temperature is more than 8 degrees Celsius. Most parts of the soil are exposed to drought for most of the time during the year, it is deep soil and the percentage of organic matter in it decreases with depth, and ground water ranges between (95-200) cm, with a predominance of fine and medium fine particles in its horizons[12]. The soils of this group are equivalent to the great group of soils known as alluvial soils in the old American system[9].

as for the classification of soils at the level of series, the classification proposed by[2] was adopted to classify Iraqi sedimentary soils at the level of series. Three types of series, namely the MI12 series, the MP12 series, and the DP117 series, were identified in the study area in general (Table 3).

Table (3) Soil classification table according to the modern American system (Soil Survey Staff, 1999) and Al-Agidi's classification of series in sedimentary soils (Al-agidi, 1976).

Pedons No.	Order	Sub order	supergroup	subgroup	Family	Series
1	Entisol	Fluvents	Torrifluvents	Typic torrifluvents	Clayey Mixed active calcareou Hyperthermic Typic torrifluven	MI12
2	Entisol	Fluvents	Torrifluvents	Typic torrifluvents	Clayey Mixed active calcareou Hyperthermic Typic torrifluven	MI12

3	Entisol	Fluvents	Torrifluvents	Typic torrifluvents	Clayey Mixed active calcareou Hyperthermic Typic torrifluven	MP12
4	Entisol	Fluvents	Torrifluvents	Typic torrifluvents	Clayey Mixed active calcareou Hyperthermic Typic torrifluven	DP117
5	Entisol	Fluvents	Torrifluvents	Typic torrifluvents	Clayey Mixed active calcareou Hyperthermic Typic torrifluven	MP12

Geomorphological description of the soils of the Kut Al-Zain region.

Pedon No	Kut Al-Zain (1)
Region name	Siba district
Location	° 30 26̀ 12 ° N ° 48 3 54.1 ° E
Slope	Nearly level
Climate	Arid
Elevation	4m
Vegetation	Barren lands
Land use	Not use
Parent materials	Calcareous Alluvium
Soil drainage	Imperfectly drained
Depth of ground water	200 cm
Physiography	River plain
Classification	MI12
Date of description	23\3\2019

Horizon	Depth/cm	Description
A	0-18	dullyellow orang (10 YR 7/3; dry) to bright brown (7.5 YR 5/6; most), clay; strong fine angular block Y; very hard (dry) very firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth
C1	18-50	dull orang(7.5 YR 7/3; dry) to dull brown (7.5 YR 5/4; most), clay; strong fine angular block Y; very hard (dry) very firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth
C2	50-160	dull yellow orange (10 YR 7/2; dry) to dull brown (7.5 YR 5/4; most), clay; strong fine angular block y; extremely hard (dry) very firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth

Geomorphological description of the soils of the Sayhan region.

Pedon No	Sayhan (2)
Region name	Siba district
Location	˚ 30 18̀ 22.5̈ N ˚ 48 15̀ 29.6̀E
Slope	Nearly level
Climate	Arid
Elevation	3m
Vegetation	Ambiance plant in semi-barren lands
Land use	Not use
Parent materials	Calcareous Alluvium
Soil drainage	Imperfectly
Depth of ground water	195 cm
Physiography	River plain
Classification	MI12
Date of description	24\1\2019

Horizon	Depth/cm	Description
A	0-28	dull brown (7.5 YR 6/3; dry) to dull brown (7.5 YR 5/3; most), clay silty; strong fine angular block Y; hard (dry) firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth
C1	28-54	dull brown (7.5 YR 5/3; dry) to dull readish brown (5 YR 5/4; most), clay; strong fine angular block Y; very hard (dry) very firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth
C2	54-87	dull orang (7.5YR 6/4; dry) tobright brown (7.5YR 6/5; most), clay; very hard (dry) very firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth
C3	87-195	dull yellow orange(10YR 6/3; dry) to dull yellowish brown (7.5 YR 5/4; most), clay; extremely hard (dry) very firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth

Geomorphological description of the soils of the Dweeb region.

Pedon No	Dweeb (3)
Region name	Dweeb district
Location	30˚ 15̀ 0.4̀ N 48˚ 19̀ 5.55̀E
Slope	Nearly level
Climate	Arid
Elevation	2-3 m

Land use	Not use
Parent materials	Calcareous Alluvium
Soil drainage	Poorly drained
Depth of ground water	185 cm
Classification	MP12
Physiography	River plain
Date of description	6\4\2019

Horizon	Depth/cm	Description
A	0-32	dull yellow orange (10 YR 7/2; dry) to dull brown (7.5 YR 5/3; most), clay; strong fine angular block Y; hard (dry) very firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth
C1	32-36	dull yellow orange (10 YR 7/3; dry) to dull orange (7.5 YR 5/4; most), clay; strong fine angular block Y; very hard (dry) very firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth
C2	36-49	dull orange (10 YR 7/3; dry) to dull yellow orange (10 YR 6/4; most), clay; very hard (dry) very firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth
C3	49-185	dull yellow orang (10 YR 6/3; dry) todull brown (7.5 YR 5/4; most), clay; strong fine angular block Y; extremely hard (dry) very firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth

Geomorphological description of the soils of the Bahar region.

Pedon No	Bahar (4)
Region name	FAW city
Location	30˚ 10̀ 11.9̀ N 48˚ 23̀ 8.9̀E
Slope	Nearly level
Climate	Arid
Elevation	1-2 m
Vegetation	Weeds and moths
Land use	Not use
Parent materials	Calcareous Alluvium
Soil drainage	poorly drained
Depth of ground water	97 cm
Classification	DP117
Physiography	River plain

Horizon	Depth/cm	Description
A	0-24	dull yellow orange (10YR 7/2; dry) to dull brown (7.5 YR 5/4; most), clay; strong fine angular block Y; slightly hard (dry) firm(moist); very sick and plastic (wet); few common few pores; few fin roots; strongly calcareous; clear smooth
C1	24-28	dull brown (7.5 YR 6/3; dry) to dull brown (7.5 YR 5/4; most), clay silty; strong fine angular block Y; slightly hard (dry); firm(moist); very sick and plastic (wet); few common few pores; few fin roots; strongly calcareous; clear smooth
C2	28-97	Light drownish gyay (7.5 YR 7/2; dry) to dull drown orange (7.5 YR 5/4; most), clay; very hard (dry) very firm(moist) sick and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth

Geomorphological description of the soils of the Ma'amer region.

Pedon No	Maemir (5)
Region name	FAW city
Location	30˚ 0.02̀ 11.5̀ N 48˚ 25̀ 31.4̀E
Slope	Nearly level
Climate	Arid
Elevation	1-2 m
Vegetation	Weeds and moths
Land use	Not use
Parent materials	Calcareous Alluvium
Soil drainage	poorly drained
Depth of ground water	95 cm
Classification	MP12
Date of description	9/3/2019

Horizon	Depth/cm	Description
A	0-24	dull yellow orange (10 YR 7/4; dry) to dull brown (7.5 YR 5/4; most), clay; strong fine angular block Y; hard (dry) firm(moist); sicky and plastic (wet); common few pores; few fin roots; strongly calcareous; clear smooth

C1	24-28	dull yellow orange (10 YR 7/2; dry) to dull yellowish brown (10 YR 5/4; most), clay; strong fine angular block Y; very hard (dry); very firm(moist); sticky and plastic (wet); few common few pores; few fin roots; strongly calcareous; clear smooth
C2	28-95	dull yellow orange(10 YR 7/4; dry) to dull orang (7.5 YR 7/3; most), clay; very hard (dry) very firm(moist); very sticky and plastic (wet); few fine pores; few fin roots; strongly calcareous; clear smooth

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