



**Study of Morphological, Physical and Chemical Characteristics of Salt Affected Soils Using Remote Sensing Technologies at Basrah Province**

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**Abstract** : This study was carried out to determine some morphological, physical and chemical properties of sedimentary salt affected soils in Basrah region east of Shatt al-Arab, and from the madina north to Abi Al-Khaseeb in the south of an area of 2819.06km<sup>2</sup>. Soil mapping units were separated using ERDAS software calculated from B4, B3, B2 and GIS spectral belts. The results of the morphological description of all the pedons showed that they represent the state of the newly formed undeveloped soils mainly composed of river sediments with the absence of diagnostic subsurface horizons. According to the prevalence of the prevailing wavelength 7.5R at drought was more than 60% of total horizons with almost equal proportions of Wavelengths 7.5YR, 5YR and 10R. Where the dominance between the wavelengths 2.5Y, 10R, 5YR and the colours ranged from Light yellow to reddish-brown heavy. Since the salinity of the soil is very important for the purposes of classification of soil and the preparation of maps and reclamation of these soils, this study aimed to study the characteristics of soils affected by salinity has separated into maps units using remote sensing technologies and geographic information systems.

**Keywords:** Remote sensing, GIS, Iraq, Soil Classification, Soil salinity, Soil survey.

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## **Introduction**

The soil salinization is a form of motivated land common, especially in the arid and semi-can salinity limit the sustainable development of any system of private production quenched in dry environments and semi-arid areas are the salinity of the soil one of the dangers extensive environmental all over the world, which is considered one of the most serious problems soil (Akramkhanov, *et al.* 2011). Salinization is

one of the main factors leading to the degradation of agricultural land and consequently a decline in production. Salinity contributes to the degradation of natural wealth and water resources, along with the latest natural factors, due to excessive temperatures and lack of water. Quantities of rainfall and human and soil type factors resulting from human misuse of water resources and overuse

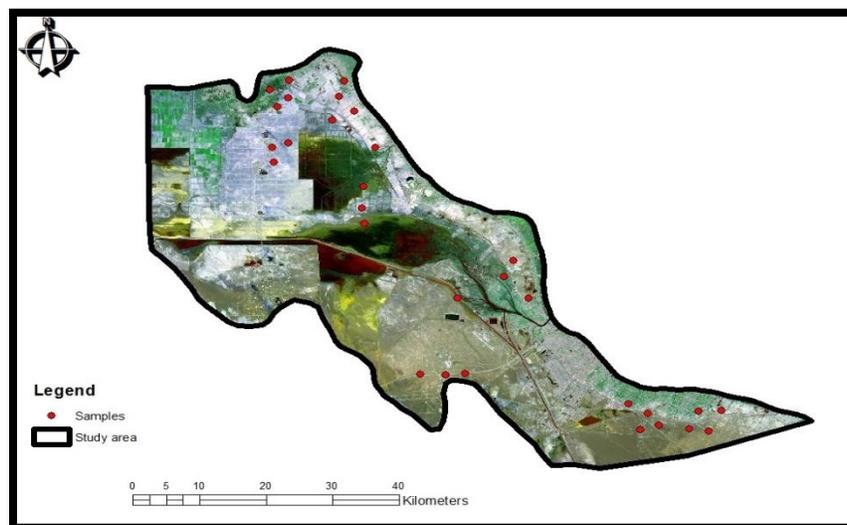
of irrigation water, which reduce the productive capacity of land degradation and turn it into saline soils (International Center for Biosaline Agriculture (ICBA). Varied soil classification systems, according to the need of the work of scientific and his background and purpose of the use of classification, with respect to soils the affected salinization several attempts to classify it has emerged these soils including Aatmdaly chemical only characteristics of which depended on the genetic side factors and composition of the soil where. Including the morphologic side as a result of operations genetic prevailing soil (Reynolds *et al.*, 2007). Emergency depends on some chemical soil properties (SAR, ESP, PH and EC) that have direct or indirect effects on its viability. plant growth and productivity the classification rules are not organized into defined or sequential taxonomic units, but in rectangular divisions (Al-Akidi, 1986). Soil classification depends on the chemical, morphological and mineral properties of the soil sector and its prospects. Soil salinity is very important for the purposes of soil of land classification as an important means for the preparation of maps management and reclamation of soils, so there have been several classifications of soils affected by salinity. Taxonomic and administrative impacts these soils were classified into three groups: saline saline, alkaline and saline, alkaline soils (Madani, 1994). Based on its chemical properties, it is classified by Richards (1954) as saline soils, sodium saline soils, non-saline soils, and geochemical classification of saline soils into salt-layer soils. Russell (1957) was the first to attempt to classify salt-affected soils

in Iraq, relying on local nomenclature of these soils, where salt-affected soils were divided into Shura and Sabkha soils are salt-containing soils that contain a high percentage of. The salts of (chlorides, magnesium nitrate and calcium) are hydrolyzed. Therefore, the surface of the marsh soils, while the soil of Al-Shura, are saline soils characterized by a white salt crust, moisture, viscosity and dark colour salts of chlorides, sodium sulfate and magnesium.

## Materials & Methods

### Location of the study area

The study included the selection of a part of the Sedimentary plain area conditions the sediments belonging to the Tigris and Euphrates rivers. It is bordered to the east by the Shatt Al-Arab River and to the west by the newly formed granular sediments Located between 47° 43 'to 47° 45' E' and 30° 21' to 30° 18 'N with a total area: 2819.06 km<sup>2</sup> as in fig. (1). A number of gaps and air correction treatments were performed, after which the contour map was drawn using Surfer 8 where Google Earth coordinates were obtained, and from Arc map10.4, corrections were made to a map from field observations and field data. From satellite visualizations with different time dates 2000, 2014 and 2017 were corrected on the satellite and converted into a digital image and separated into eight categories depending on the salt guide using the program Erdas 8.4.



**Fig. (1): Location of the study area in the southern part of Iraq.**

The study area was visited times during the period from only one month. The study area was determined after using the ERDAS

IMAGINE 2014 satellite imagery from the USGS and Landsat satellite imagery for the study period 2016-2019. (Table 1).

**Table (1): Some of the information and the characteristics of the space visuals used in the study.**

Date of visual capture	Precision discriminatory	Type sensor	Moon name
2000	30*30m	ETM+	Landsat7
2014	30*30m	OLI	Landsat8
2017	30*30m	OLI	Landsat8

### Geomorphology study area

The study area is located within the dry desert climate, which is characterized by the southern part of Iraq (Shalash, 1988). Basrah has a desert climate so warm classified according to the classification of koppen as a desert climate like the rest of the surrounding area, despite its proximity to the Arabian Gulf, which contributes to increased precipitation rates compared to the other stations. In the winter, the weather is mild and the average temperature is about 20 degrees Celsius (68

degrees Fihrnhith). The relative humidity was sometimes up to 90% is common because of the proximity of the Arabian Gulf.. As for the wind speed, it was the maximum wind speed is a monthly average estimated in August to 5.30 m . sec<sup>-1</sup> The average temperature monthly reached in the month of July 39.80 Celsius so longer soils with a thermal system of the study area of the type Hyperthermic and to the fact that the annual average temperature of more than 22 m degree Celsius and its moisture type Torric (Aridic) exposure to soil drought

throughout the days of the year. The amount of solar radiation reaching the Earth's surface is directly proportional to the brightness of the sun, the actual duration of the actual brightness rates take an upwards after the month of March, reaching the highest value in the month of September, then begin to decline as it reaches the lowest value in December. As well as natural plants a significant role in an increasing the salt on the soil surface through the plants that absorb water by leaving the roots at the root salt layer growth. Spread different kinds of natural plants in the study area which varies according to the distribution of soil and variability. The desert plants prevailing in the study area, which is within the desert climate warm, as Tzafart conditions of climatic zone extremes in temperature and lack of large water processing in the adaptation of plants to cope harsh conditions, and represent desert plants in the study area are thorns and ideals and blink. (Zughayyar *et al.*, 2016). As for the natural vegetation in the study area is sparse and dominated by desert plants (Abdul-Qadir & Benni., 2010)

### Field procedures

It included several exploratory rounds through which identify sites Al piedones s in nature and number 8 Piedones and determine the coordinates of Apiedones sites and alhufar almuthqabia and number 30 on the satellite visual using a GPS device and took three surface sites samples Auger hold for each site and took samples of the soil surface from all locations and depths 0 to 10, 10-20, 20-30, 30-40, 40-100 cm for a period of 3/3 / 2018-5/4/2018, was documented information about the study area Haklaa soils "as recorded

locational information for each of them, which included both" of the cover vegetation and land use recipes site. piedones was described by morphology as described in the Soil Survey Staff Manual (Soil Survey Staff, 2003). and then the morphology was described and. The soil samples were taken from each horizon after isolating the soil units in the study area for the purpose of conducting the laboratory analysis required to studying some physical characteristics. and chemical to utilize in remote sensing data extraction.

## Results & Discussion

### Morphological characteristics

The results of the morphological description of Pedone study in table (2) that piedones s these soils consist of the prospects of a thickness ranging between 19 and 86 cm for holes and between 134 and 180 cm in depth table (4) showed the values of the dominant wave length (Hue) 7.5R when drought by more than 60% of the total horizons with almost equal proportions of the wavelengths 7.5YR, 5YR and 10R for the intensity (value) ranged from (5-7) Chroma colour ranged from (1-3) and the colour of the soil of the study sites ranged from reddish lead to heavy reddish brown. As for the colour trait in the wet state, the horizons of soil piedones were distributed in terms of dominance among the wavelengths 2.5Y, and 10R, 5YR. Its colours ranged from light yellow to heavy reddish brown and the changes in intensity between wet and dry condition were slight (4-7). And The highest change in the intensity (Value) got in deep horizons As for the degree of purity Chroma has shown most of the soil prospects increase in soil composition in the wet state compared to the dry state and the

**Table (2): Morphological characteristics of soil.**

Location	Horizons	depth cm	the colour		Camellia is a state of deca	Moisturizing condition
			Dry condition	Wet state		
Mdinah	A	0-38	7.5 R6/1 reddish gray	2.5 Y7/3 light yellow	Soft	Very sticky Non Sticky Friable
	C1	38-86	5YR6/1 reddish gray	2.5Y7/3 light yellow	Hard	Sticky Plastic Very Firm
	C2	86-136	7.5R7/1 higher reddish gray	2.5Y7/3 grayish yellow	Very Hard	Sticky Slightly plastic Firm
	C3	+136	2.5YR7/1 light reddish gray	2.5Y7/2 grayish yellow	Very Hard	Sticky Non Sticky Very resistant
Sharsh	A	0-34	7.5R 7/1 lighr reddish gray	10R 4/1 drak reddish gray	Very Hard	Non sticky Plastic Friable
	C1	34-90	2.5R7/1 light reddish gray	10YR6/4 dull yellow orange	Very Hard	Slightly Sticky Plastic Very Firm
	C2	+90	7.5 R7/1 light reddish gray	5 Y 7/2 light gray	Hard	Sticky Plastic Very Firm
Shafi	A	0-28	7.5R7/1 higher reddish gray	10 YR6/1 browish gray	Solid gatherings	Non sticky Plastic Firm
	C1	28-71	7.5 R6/1 reddish gray	10YR6/4 dull yellow orange	Slightly hard	Sticky Plastic Firm
	C2	71-133	7.5 R6/1 reddish gray	2.5Y8/2 light gray	Slightly hard	Non sticky Plastic Firm
	C3	+113	7.5 R6/1 reddish gray	2.5 YR5/4 dull reddish brown	very Hard	Sticky Non Sticky Firm
Deyer	A	0-34	7.5 R5/1 reddish gray	7.5 R6/1 reddish gray	Soft	Sticky Plastic Firm
	C1	34-62	7.5 R6/1 brownish gray	2.5 Y 7/3 light yellow	Soft	Very sticky Plastic Very Firm
	C2	62-100	7.5YR6/1 reddish gray	10 YR 6/4 dull yellow orange	Very solid congregations break hard with both hands	Sticky Plastic Firm
	C3	+100	7.5YR6/1 reddish gray	5YR 5/3 dull reddish brown	The assemblies are broken very hard by thumb and fingers	Sticky Slightly plastic Very Firm

Basrah Ariport	A	0-21	7.5 R7/1 light reddish gray	5YR7/4 dull orange	Hard	Very sticky	Slightly plastic	Very resistant
	C1	21-111	7.5 YR7/3 dull orange	5 YR 5/4 dull reddish brown	Very Hard	Slightly Sticky	Plastic	Firm
	C2	111-160	7.5 R7/1 light reddish gray	10 R 5/4 reddish brown	Slightly hard	Sticky	Plastic	Firm
Shaaiba	A	0-24	10R 6/1 reddish gray	7.5R6/1 reddish gray	Slightly hard	Sticky	Non Sticky	Firm
	C1	24-52	7.5 YR 6/1 brownish gray	5YR6/2 grayish brown	Slightly hard	Sticky	Non Sticky	Firm
	C2	+52	10R5/3 reddish brown	7.5YR6/4 dull orange	Very Hard	Sticky	Slightly plastic	Firm
Tallal al- Hamza	A	0-29	7.5R 6/1 Reddish gray	10YR 6/4 dull yellow orange	Slightly hard	Sticky	Slightly plastic	Friable
	C1	29-49	7.5 R 6/1 brownish gray	7.5 YR 6/4 dull orange	Slightly hard	Non sticky	Plastic	Very Firm
	C2	49-109	7.5 R 6/1 reddish gray	2.5 YR 6/3 dull orange	Slightly hard	Slightly Sticky	Slightly plastic	Very Firm
	C3	+109	7.5 R6/1 reddish gray	5YR6/2 grayish brown	Hard	Very Sticky	Non Sticky	Very Firm
Kot al-zain	A	0-19	7.5 R 5/3 dull reddish brown	10R 5/4 reddish brown	Soft	Sticky	Slightly plastic	Friable
	C1	19-78	7.5 R5/3 dull reddish gray	10R 6/4 dull reddish orange	Slightly hard	Sticky	Plastic	Firm
	C2	78-133	7.5 R6/3 dull reddish orange	10 R5/4 reddish brown	Hard	Sticky	Plastic	Firm
	C3	133-160	7.5 R 6/1 reddish gray	7.5 YR5/4 dull reddish brown	Hard	Slightly Sticky	Plastic	Very Firm

values of purity of all soils ranged between (4-1) that the variation in the color of the horizons is due to the difference in the nature of the soils components from the presence of salts, lime pools and organic content as well as the state of constituent oxides deposited with soil particles This is consistent with what Atzberger (2002) describe that the wide variation in the prevailing wave values of the soil of the study area was due to the convergence in the intensity of oxidation and reduction potential and the advantage of covariance and for each depth .This is consistent with both Kadhim (2017) and Al-Hayali (2009). It showed a clear difference, especially layer C1 (5YR 6/2) and healing layer C2 (2.5Y8 / 2). This is consistent with Ekinci, *et al.* (2004) that the dark color of the purity is low chroma) due to the presence of organic matter. For long saturation the value was 3 - 4 (dry and moisture) in topsoil. On the other hand, the color is changed due to the redoximorphic feature (10GY 6/1) in the subsurface horizon and the accumulation of carbonate (high value 2.5YR7 / 3). Besides, carbonate and mycelium nodules were identified within a depth of 120 cm due to the calcification process, and the occurrence of bloating due to the processes of humidification and drying

Then the soil shrinkage that occurs as a result of washing surface materials in these cracks. These results are consistent with Ahmad (1983). Open cracks that are up to a depth of 50 cm and at least 1 cm width and extend upward to the surface, base of the plow layer, or surface may appear as in Soil Survey Staff (1975). This is consistent with what Yahya (2016) found presented that the soil color of the study site

ranged from light yellowish-gray to very pale brown in the dry case, while in the wet condition has ranged between brown and yellowish brown and dark yellowish brown and it was noted that some soils in some horizons were characterized by white colour and. This variation in color small prospects are due to the difference in the nature of soil constituents of salts in some surface horizons of soil pidons of the study area, lime concentrations and gypsum ,which was high in some subsurface horizons the values of organic matter, and the state of deterioration experienced by these soils.

As for the spot turned out results and traces of staining in all Bedonat soils except Pedone city does with the effects of the staining either the rest of the soil is found in the third depth C2 for Kot Al-Zain, Talaa Al Hamzah, Shuaiba, and Deir , where the percentage of spotting was 40% was in the Shuaiba ratio of 20% either spotting in Talaa al-Hamza ratio was 10% spotting as the soil colour was gray. Gray with 40% hard been Spotting was also found in the fourth depth C3 for biedons Talaa Al- Hamza pollen, where the stain was 30-40% , the size of the stains was large and the colour of the stain was gray. Salt or soil salinity it was evident in both Biedon Shuaiba and Basrah airport either in Talaa al-Hamza was within the horizon C2 As for the presence of calcium carbonate was found in the first and second surface horizon where it was found in the horizon A in biedon Kot Al Zain, while in Bedon Shuaiba ,Shafi and almadina was found within the horizon C1 where the thickness was at the horizon of Shuaiba 6 cm and can be found from table (2) that the structure units The similarity in the type of unite showed that the dominant of the type of mass construction was sharp angles in most of

the Biedones, as it is clear that most of the soil of the study area showed a weak structure to no-structure at all, as it is newly formed soils located in dry areas where the organic content of the weak vegetation, especially in the horizons. Upper A, C1 except Biedon Sharash the effect of high concentrations of salts in their direct effect on the stability of the of indirectly in the growth and density of vegetation. There are prospects that showed strong construction to very strong soils and this indicates the prevalence of expansion and contraction processes due to moisturizing and drying processes (Moussawi *et al.*, 2002; Reatto *et al.*, 2009) as evidenced by the results that most soils study area showed building weak to very weak, especially in the upper horizons A, C1 except Piedone Shuaiba showed a strong building on the horizon A, the sovereignty of the weak construction to colourless construction in these prospects being soils modern located within the dry areas with Effect of high concentrations of salts and its impact indirect in the growth and density of vegetation on the effect of soil concentrations while strong construction is distributed on the horizon, the second C1 in the areas that were flooded the marshes in Biedones Al- Shafi and Medina. As for the plastisty characteristic, there was a dominance of the plastisty characteristic for most of the soil piedones, especially in the subsoil horizons. and the Tallaal-Al Hamzah. Some of the piedons in their surface horizons showed a characteristic of low plastisty to plastity less in Horizon A, as in the city of pedon, Basrah airport, Shuaiba, Tallaal Al-Hamza and Kot Al-Zain soil of the Soils Floodplain. The variance in rubber values between soil piedons and their prospects is due

to the mineral and physical properties of the dominant soil grains which are determined by the clay content and the type of dominant minerals. The case Qguamah soil in the case of moisture has prevailed in the case of soil texture coherent to a very coherent in most of the prospects Bedonat soil studied with the exception of some of the horizon A Al pedons city Sharash and Talaa Hamzah and Kot Al-Zain. This may be due to organic disparity between surface and subsurface horizons or different organic content between the surface and subsurface horizons or different organic content of the prospects, which have the highest surface layer, what can this content has a role in making Building a fragile soil. These results are consistent with Maogda and these findings are consistent with what the Sullivan (2004) and Hayali (2013) that the soil content of minutes clay partical leads to the soil to be sticky when moisturizing and solid when drought.

### Physical properties

Indicate the results of the distribution volumetric minutes of soil horizons study sections table (3) to the variation in the values of average MWD with depth of prospects Biedoens all of the study area as varied values between the prospects and spatially between

Alpedones with volumetric distribution of minutes of soil variation and content of organic matter and exploitation of the Agricultural nature of the administrative processes that take place on them, the values ranged weighted average diameter of the prospects of the study area between 0.297-0.041 where the values of average weighted surface diameter approved 0.124-0.101-0.075-0.102-0.076-1.487-0.073-

0.146 mm is clear from the results that the highest Qatar's weighted average afternoon when Surface horizons A most Bedon study area with the exception of Biedone Mdinah Piedone Shuaiba and Pedone Kot Al- Zain, who were the superiority of the agreed C1 on the rest of the prospects and this is due to the outcome of influence among the factors that increase the proportion of the vital factor of organic content and overlap with the adverse effect of higher concentration, In the MWD where the concentration of salts above what can be in the surface layers except the Mdinah and this is consistent with the findings of Al-Ani *et al.* (2000) was the reason back to the high conductivity values of electrical soil and the concentration of high sodium in which ion which leads to dispersion of soil minutes from each other and reduces soil stability pools (Kijne and Bishay, 1974). In general MWD in this country are very low Alpedones due to increased soil content of sand, which reduces the concentrations of soil stability as well as their content is little organic matter. Results shown in the table (3). The study area Bedonat tissues ranged from clay to Almazijh placer and that sovereignty was Almazijh of tissues placer. It marked prospects for Bedons tissues of the study area for the presence of cases Alasttabaq in Alencjh Amapalnsph to the effect of the spatial distribution in the tissues of the soil Bedones study area showed a clear discrepancy Balencjh. This depends on the nature or effect of factor geomorphological characteristics of the carrier and the speed of which affects the size of the transferred minutes in the deposition layer. This influence was evident in the presence of the great disparity in the nature of the carrier velocity in periods of deposition

layers or prospects of deep soil prospects for C2 and C3 while the back of the horizon C1 in most Bedones soil of the study area to increase the proportion of soft minutes, making this Al pedones rise Vihansbh soft minutes of mud Dahlgren also in the city and Bedones Shafi and Basrah airport and Shuaiba. While Zarhma Alathervi C2 of Alpedones located in the south of the study area of Talaa Al-Hamza and Kot Zain class either for surface approved may cushion Alencjh Almazijh placer in Bedones easy Faydi represented in Bedonat city and the airport of Basrah, Sharash and Shuaiba either in Bedonat Talaa Hamzah and Cote Zain showed the prospects of the horizon surface a increase in the proportion of soft clay minutes was a fusion to fusion clay silt that the increase in the proportion of soft minutes Viatabqh surface Talaa al-Hamza and kout al Zain refers to the decrease in the speed of the carrier during the deposition of these layers In other pedons, the velocity of the conductor there is similar in the velocity of the conducting current when these layers are deposited. This effect was aresult of the presence of large variation at nature of the carrier speed in the sedimentation periods or deep horizons of the soil (C2, C3) while the horizon C1 appeared in most soils Bedon of the study area increased the proportion of soft minutes, which made these pedons rise in the proportion of soft minutes of mud And Algreen as in the city Bedon, Shafi, Basrah airport and

Shuaiba. While this archaeological C2 layer at south of the study area emerged from the pollen of Hamza and Kot Al-Zain as for the surface horizon, the masters of the alluvial mixture in the flood plain of Baydounat represented in al madina and Basrah airport, Al-Sharsh and Shuaiba. An increase in the ratio of

soft particles was a clay mix to an alluvial clay mix. The increase in the proportion of the soft surface of minutes Viatabqh to Talaa Hamzah and Kot Al- Zain refers to the decreasing in the speed of the carrier during the deposition of these layers either in other Alpedons, the speed of the carrier there are similar in the carrier's current speed when the deposition of these layers. This is consistent with Al-Moussawi (2005) that the sedimentary soils vary abruptly and not surprisingly because they consisted of stratified sedimentary materials, all of which are Bedones, and since the geological factor effectively influences the studied soils. The results of the mechanical analysis of soil separations (Table 3) and the morphological description of soil tissue showed that most of the study bedoons had a relatively high content of clay with a highest values in the horizon C3 of 81,333 while the lowest values were in the horizon of Shuaiba C1 with a value of 23,266 which effect on the appearance of clay-to- clay alluvial tissues, as in the pedons which showed the dominance of mud healing C3, Healing C1, C2, Kot al-Zain C2, Sharq C2, Kot Al-Zain C3, Basrah Airport C2 and Shuaiba, where values ranged between 81,333-61,862-60,357-56,08-53,416-52,414 -45,398 23,266- respectively, except for the prospects of Kot Al -Zain C1, C2, Shuaiba A, Sharash A, C1 and Mdinah A, C1, C2, C3 and C4, which reflected the presence of alluvial and alluvial mixtures and this is consistent with Wheib and Ibrahim (2012) they confirmed the dominance of silted silt in this type of soil. The differences in soil percentages are due to the relative different locations of the pedones in the study area, as well as the different source of sedimentation and sedimentary conditions that helped form in

the formation of sedimentary soils in Iraq and the associated geomorphological processes responsible for the horizontal and vertical distribution of soil particles in these areas (Al-Mashhadani, 1994). The results in table (3) showed that there is an increase in the bulk density values for most soil pedon due to the untapped soils affected by salts and low salt content. The highest values were found in pedon Al-Sharash and Basrah airport, of 1.450 and 1.417 respectively, where clay-based soils were characterized by higher values of bulk density compared to the bulk density values of other soils. The rise in bulk density can be attributed to the role of salts in the degradation of soil properties, especially sodium ions, which break down soil clusters and disperse the minutes leading to clogged porosity spaces and low percentage and increase the bulk density, as indicated by (Cullu *et al.*, 2000; Al-Nabulsi, 2001). They also had varying values according to the estimated prospects.

#### **Soil Chemical Characteristics Properties**

The results studied were found in the table (4) The chemical properties of the soils pedones study, where the results suggest there is a slight difference in pH value between the soils study area where values ranged between 7.8 - 7.1 According to the US classification Soil Survey Division Staff (1993) as the increase in the soil content of calcium carbonate minerals increase the degree of interaction towards alkaline. It refers to the degree of alkaline reaction to contain these soils on the proportions of calcium carbonate. It can also be attributed to the presence of ions of sodium bicarbonate and sodium soluble, which led to obtain calcium

Table: (3) shows the physical properties of the soil.

Bulk Density Mg m <sup>-3</sup>	Depth cm	Horizons	Average Weighted Diameter	Texture	Porosity %	Partical Density Mg m <sup>-3</sup>	Bulk Density Mg m <sup>-3</sup>	Depth cm	Horizons	Location
0.076	Silty loamy	560	160	280	48.116	2.575	1.336	38-0	A	MMdaina
0.291	Silty Clay loamy	652.06	326.03	8.15	43.893	2.579	1.447	86-38	C1	
0.139	Silty loam	694.45	285.94	3.06	40.901	2.555	1.510	136-86	C2	
0.080	Silty loam	604.45	324.18	39.5	48.685	2.549	1.308	+136	C3	
0.297	Silty Loam	716.24	126.34	144.3	44.950	2.634	1.450	34-0	A	SSharsh
0.223	Silty Loam	549.57	422.74	2.11	46.075	2.663	1.436	90-34	C1	
0.071	Clay Loam	356.11	534.16	7.7	46.021	2.677	1.445	+90	C2	
0.346	Loam	440	488	62	49.961	2.596	1.299	28-0	A	Shafi
0.098	Clay	371.17	618.62	2	45.240	2.573	1.409	71-28	C1	
0.042	Silty Clay	388.02	603.57	1.07	50.666	2.550	1.258	113-71	C2	
0.073	Silty loam	192	672	136	43.449	2.557	1.446	+113	C3	DDeyer
0.146	Silty Loam	460.26	167.3	359.83	46.934	2.576	1.367	34-0	A	
0.135	Silty loam	504.57	168.19	294.33	48.219	2.611	1.352	62-34	C1	
0.090	Silty loam	780.61	205.42	10.27	47.576	2.558	1.341	100-62	C2	
0.165	Silty loam	706.86	166.32	92.5	44.662	2.572	1.449	+100	C3	BBasrah ariport
0.075	Silty Loam	612.07	326.43	55.08	44.735	2.564	1.417	0-21	A	
0.060	Silty Clay	400	560	9	47.150	2.592	1.370	21-111	C1	
0.070	Silty Clay	445.25	453.98	11.34	44.376	2.569	1.429	111-160	C2	
0.102	Silty Loam	801.09	42.16	119.11	48.666	2.587	1.328	24-0	A	

0.315	Clay Loam	698	232.66	37.22	49.881	2.561	1.273	52-24	C1	Shaaiba
0.045	Silty Clay Loam	511.56	255.78	3.19	40.232	2.540	1.518	+52	C2	
0.101	Silty clay loam	436.82	436.82	110.24	51.05	2.588	1.176	29-0	A	Tall al-Hamza
0.086	Loam	583.22	179.45	224.31	49.258	2.627	1.333	49-29	C1	
0.144	Clay loamy	419.02	419.02	49.23	47.810	2.617	1.366	109-49	C2	
0.049	Silty Clay loamy	591.97	410.54	16.91	47.857	2.591	1.351	+109	C3	Kot Al zain
0.124	Clay loamy	604	372	24	46.734	2.642	1.427	0-19	A	
0.144	Silty loam	788.71	166.04	49.81	49.646	2.679	1.349	19-78	C1	
0.262	Clay loamy	443.5	524.14	5.03	44.840	2.625	1.462	78-133	C2	
0.041	Silty loam	510	140	344	45.840	2.596	1.406	133-160	C3	

carbonate and magnesium during evaporation (Deshmukh, 2012).

It is noted that the different content of solid calcium carbonate horizontally and vertically, during the horizons of the pedons, the study area has shown most of the soil pedons increased in the content of solid carbonates with depth. It appeared so obvious in Bedon madina and sharsh Kot al Zain. This curve corresponded with the high carbonate content in general for these pedons and this is due to the presence of a large similarity in the sources of carbonate in these soils as they represent extensions of the environment of the marshes and wet areas, but was subjected to drying processes for a period where the concentration of carbonate in their shells, the variation in the higher carbonate concentration during the horizons of one pedons depend on the length of time for the continuation of the aquatic environment and the activity of the combined carbonate organisms. For soil salinity values of the soil extract paste at pedones study, it showed a variation of prospects of Bedons soil in salinity, as was the adoption of the classification of Soil Survey Division Staff (1993). It notes that the conductivity values Alkahraiah to Bedon study area is located between the medium to high soil salinity and salinity ranged between 19.48-136.1 ds. m<sup>-1</sup>. And less electric delivery appeared about the prospects Alipidon Shafi and prospects Alipidon Sharash C3, C2, as it stood at 19.3-20.7 ds. m<sup>-1</sup> and then Pedone Shafi comes in sight C1 of 22.1 ds. m<sup>-1</sup>. While the highest electrical conductivity appeared on the prospects of the Bedon Kot Al Zain horizon A as it reached 136 ds. m<sup>-1</sup>. It is evident that there is a spatial variation in the values of

electrical conductivity and can explain the phenomenon of high salinity in these sites in the fact that they are located in areas of low topography in comparison with the areas of the highlands in the north and the areas of the rivers of the south, which led to exposure in the past to flood conditions, which caused high levels groundwater, where secondary salinization occurred when water withdrawal in dry conditions, which led to the accumulation of salts in the soil section, especially surface prospects as a result of evaporation of water from the surface. This shows the vertical movement of soluble salts in the Introduction of soil and eventually deposited in the surface layers, which may eventually lead in the affected soil of salt in the development of a long period, or may be due to the high capillary movement of water with dissolved salts on both capillary movement and the side of the water has changed the balance of salt (Chhabra, 1996; Rengasamy, 2010). It can be seen from the results of table (4) that there is the rule of sodium ions on the rest of the dissolved. The order of values refers to the existence of the rule of dissolved sodium ion compared to the rest of the Cations as constituting of (483.152), followed by Mg ion and form a ratio of (201.5) of the total ions then calcium ion by 70.5 and finally potassium ion at a rate of 3.387. This confirms that these results confirm the predominance of sodium ion in these saline soils. It is noted that sodium ions increase with increasing EC values in the horizons, whether it is the spatial variation of the locations of the pedons. Secondary based on the property of the capillary as a result of the process of salinization or overlap desalinization process, which is affected by the level of ground water,

Which is affected by the level of ground water, which increased the activity of the process of water up. Soils of shallow groundwater level showed the highest concentrations of sodium ions at the surface layers and high differences between the surface and subsurface layers. With the exception of some Bedons or the study area that showed surface horizon A decreased by horizon, followed by Shuaiba and some other possibilities that suffer from the presence of a deaf layer at the horizon C2 reduced the flow of ground water to the upper horizons, as in the horizon, which showed an increase in sodium value compared to the horizon below. Results of table (4) showed that the organic content of the prospects of the study area, decreased with which ranges between (0.182- 4.371) due to the poor of vegetation due to the decrease in precipitation rates and, high evaporation effort and the accumulation of salt in most soils. Most of the prospects of the study showed that the highest values of organic content at surface layer and decrease gradually with increasing depth as in the prospects of reaching the lowest values at the deep horizons due to the effect of vegetation and the spread of roots in the soil prevail in the surface layer while some Alipidonat showed a decline at horizon C1 compared to An increasing in the organic content at the horizon C2 or C3 were obtained as compared with horizon C1 except for some piedones where prospects have shown under the surface to increase the organic content as in the prospects C2 and C3 compared to the rest of the prospects, including a piedon city and the horizon C1 in Pedone Sharash. This is due to the impact of the previous type of exploitation and the spread of plants with deep roots such as cane and blossom plants, whose

effects remained in the depths of the soil depending on the density of roots and weak decomposition processes due to the bestowal conditions experienced by the former marshes. The results indicated that all the piedones of the study site showed that the calcium sulfate content ranged between 1.474 and 7.662 g.Kg<sup>-1</sup> for surface horizons and 0.025 and 5.716 gKg<sup>-1</sup> for subsurface horizons. There was a variation in the distribution of gypsum within the unit with the highest surface horizon content for most of the study area, and this is consistent with Ismail (2017). It was found that the gypsum content is higher in most surface horizons compared to the subsurface horizons. Gypsum according to its geographical and topographic location. The highest values were in Horizon A for the site of the whey at a rate of 7.662 g.Kg<sup>-1</sup> followed by the horizon C1 for the site of Kout al-Zein with a value of 5.716 g.Kg<sup>-1</sup>. While the lowest values on the horizon C3 for the site of Hamza Talaa by 0.025 g. Kg<sup>-1</sup> and then horizon C1 for the location of the airport of Basrah and 0.087, respectively. Calcium sulphate, depending on the solubility product CaSO<sub>4</sub>, has contributed to the accumulation of gypsum. The results showed that the distribution of CEC values for the prospects of the study area ranged from 8.400-41.230 m 100 meq/100gm soils. It is clear from the results that the highest values appeared on the surface horizon of most soil Bedons and the values decrease with depth due to the effect of organic content which increases at the surface horizons and decreases with the depth (Ismail *et al.*, 2017) and that the highest CEC values of the surface horizons in the Bedons located in the part. This may be due to the effect of organic soil components and the prevalence of

Table (4): Soil chemical characteristic properties.

ESP%	SAR%	Organic matter gKg <sup>-1</sup>	CEC Cmol.kg <sup>-1</sup>	CaSO <sub>4</sub> gKg <sup>-1</sup>	CaCO <sub>3</sub> gKg <sup>-1</sup>	EC Dsm <sup>-1</sup>	PH	Depth cm	Horizons	Location
24.88749	23.317	2.195	20.400	6.943	42.500	71.3	7.478	38-0	A	MMdinah
10.67729	8.9583	0.910	14.600	0.176	44.000	23.3	7.317	86-38	C1	
4.915599	4.3591	1.457	16.400	2.832	48.500	29.8	7.253	136-86	C2	
14.79871	12.629	1.457	26.400	0.497	50.000	27.6	7.302	+136	C3	
28.46706	27.834	1.457	25.200	7.662	40.000	79.9	7.452	34-0	A	SSharsh
6.653024	5.6862	2.003	20.600	0.467	50.000	24.3	7.247	90-34	C1	
2.929013	2.8999	1.821	18.600	0.607	50.500	20.7	7.725	+90	C2	
21.81321	19.768	4.371	24.000	5.167	43.000	89.3	7.245	28-0	A	Shafi
16.34835	14.103	2.185	20.400	0.115	46.500	22.1	7.878	71-28	C1	
18.09061	15.827	1.457	10.200	0.112	45.500	33.4	7.381	113-71	C2	
13.45434	11.393	0.910	24.400	0.219	45.000	19.48	7.494	+113	C3	
15.65977	13.442	2.185	32.400	4.985	37.500	104.00	7.246	34-0	A	DDeyer
13.36314	11.311	1.092	24.000	2.138	43.000	51.400	7.286	62-34	C1	
16.43963	14.192	1.457	18.400	0.789	34.500	31.1	7.175	100-62	C2	
11.70933	9.8455	0.364	14.000	0.225	32.500	24.5	7.637	+100	C3	
26.65642	25.494	1.639	8.400	1.474	40.000	86.7	7.204	0-21	A	BBasrah
24.5148	22.872	0.182	18.000	0.087	38.500	42.9	7.386	21-111	C1	
25.78365	24.407	1.275	14.200	3.212	39.500	47.2	7.309	111-160	C2	

28.56883	27.969	1.275	30.400	3.436	43.000	84.5	7.369	24-0	A	Shaaiba
29.55374	29.296	0.728	32.000	2.764	37.500	88.2	7.263	52-24	C1	
22.33355	20.349	0.728	25.800	0.109	37.500	42.7	7.269	+52	C2	
35.15785	37.614	2.914	23.000	5.480	44.500	129.4	7.214	29-0	A	Tallal al- Hamza
25.0242	23.482	1.092	41.230	4.942	38.500	93.9	7.253	49-29	C1	
24.01451	22.280	1.092	12.800	3.305	45.500	65.6	7.502	109-49	C2	
26.19326	24.914	1.275	32.000	0.025	47.500	78.4	7.230	+109	C3	
24.56279	22.929	2.550	32.400	4.870	35.500	136.1	7.245	0-19	A	Kout alzein
14.47945	12.332	0.546	18.000	5.716	40.000	47.9	7.312	19-78	C1	
20.91383	18.782	0.182	34.400	1.761	47.000	29.00	7.219	78-133	C2	
17.40746	15.143	0.910	21.800	0.992	43.500	31.200	7.275	133-160	C3	

**Table (5): Classification of Soils by Modern American System (Soil Survey Staff, 1999) and the classification of the chains in the sedimentary soils (Al-Agidi, 1976).**

No.pedon	Order	Sub order	G.S. G	Sub group	Fimaly	Series
1	Entisols	Fluents	Torrifluents	Typic torrifluents	Fine silty ; Mixed ; active ; calcareous; Hyperthermic Typic torrifluents	TE 955
2	Entisols	Fluents	Torrifluents	Typic torrifluents	Fine silty ; Mixed ; active ; calcareous; hyperthermic Typic torrifluents	DW57
3	Entisols	Psamments	Torripasmments	Typic torrifluents	Fine silty; Mixed ; active ; calcareous; hyperthermic Typic torrifluents	TM1275
4	Entisols	Fluents	Torrifluents	Typic torrifluents	Fine silty; Mixed ; active ; calcareous ; hyperthermic Typic torrifluents	TM555
5	Entisols	Psamments	Torripasmments	Typic Torripasmments	Sandy; Mixed ; active ; calcareous ; hyperthermic Typic Torripasmments	DW117
6	Entisols	Psamments	Torripasmments	Typic Torripasmments	Coarse loamy; Mixed ; active ; calcareous ; hyperthermic Typic Torripasmments	DM116
7	Entisols	Fluents	Torrifluents	Typic torrifluents	Silt loam; Mixed ; active ; calcareous ; hyperthermic Typic torrifluents	TI476
8	Entisols	Fluents	Torrifluents	Typic torrifluents	Silt loam; Mixed ; active ; calcareous ; hyperthermic Typic torrifluents	TM575

expanded clay minerals, Mont, which tends to settle at the ends of the streams and flooding.

#### **Soil classification:**

The soils surveyed according to the modern American classification (Soil Survey Staff, 1999) were classified to grade level, sub-grade, super-group, sub-group and family, and the proposed classification of Iraqi sedimentary soils at the chains level by Al-Agidi (1976) as in table (5).

For soils, the study area lies mostly within the rank of the newly formed soils (Entisol), because the main characteristic of the soils of this rank is the modernity of the evolutionary state, due to the absence of prospects of gain, including the developed clay horizon (Argillic horizon), which is the horizon of the clay pool transferred from the upper horizons. Because the time factor is still insufficient to form the horizon of gain B and all the soils are located in the sedimentary plain, which receives new sediments from the sedimentary material at frequent intervals of time, which has helped to weaken the pedogenic activity in these soils (Buringh, 1960). These soils were characterized by the presence of the Ochric surface horizon, which is characterized by light colour with low organic matter content and the value of value 4 or more in the wet state and 6 or more in the dry state, and the absence of other diagnostic horizons such as saline horizon or Calcic, calcium-like (Ptrocalcic), (gypsic) or gypsum-like (Ptrogypsic), with the dominance of the dry moisture system. At the level below the level is (Fluvents) as these soils are composed of river sediments newly formed and characterized by the state of stratification and mostly movable and derived from rocks, soil nudged or coasts of rivers, and contain a quantity of organic carbon with parts of clay,

which are located in the areas of its decline Less than 25% and not exposed to waterlogging within 50 cm of the soil surface, the soil moisture ranged between 2.44 - 6.24%, and its thermal system is higher than the cold system (Cryic) in which the temperature ranges between 0-8 ° C, free of rock layers or Semi-rocky within 25 cm depth of the soil surface.

At the taxonomic level, the large group falls within the group (Torrifluvents), which is characterized by the presence of river sediments in a hot dry climate and is located under the humidity system of type (Torrlic), one of the soil moisture systems in which the soil is dry in all its parts for more than half of the time When the temperature of the soil at depth 50 cm more than 5 degrees Celsius, and moisture is not available for more than 90 days consecutively when the temperature is more than 8° degrees Celsius. Most parts of the soil without drying during the year, which is deep soil and the proportion of material Its organic decreases with depth and ground water is close to the surface with Sovereignty for soft (Soil Survey Staff, 1999). Soil classification under the group and depending on the extent to which the characteristics of the soil of the model group to the higher levels (grade and sub-grade and the maximum group) match the results of the current study shows that the soil of this path fall under the group (Typic Torrifluvents) because it has the typical characteristics of the maximum group and represents Where the characteristics of the ideal state, which are characterized by the following:

1- where the horizon is not more than 15 cm thick during the first meter of the soil surface contains more than 20% holding solid (durinodes) in the ground is fragile or brittle and with solid cohesion when wet.

2- does not have the following qualities: -

(a)-Cracks for periods and for most days 125 cm from the surface of recoil soil 5 cm or more and a depth of 30 cm or more.

(b)- More than 30% of the clay horizons in which the total thickness of more than 50 cm within the first meter.

3. Does not have an anthropic horizon, which is a surface horizon similar to the horizon molar with high content of P<sub>2</sub>O<sub>5</sub> as a result of human use of the soil.

4- Dry in all parts of the classification section for three quarters of a year or more and soil temperature over 5 ° C and a depth of 50 cm.

As for the family and depending on the characteristics of tissue and soil sector temperature and limestone status and clay minerals were diagnosed six families, as shown in Table (5) where the prevalence of the hot and dry thermal system (hyperthermic) where the temperature at the depth of 50 cm more than 22 degrees Celsius and a mixture of minerals Clay, which included the following clay minerals: montmorillonite interfering with chlorite, balekorskite, elite, chlorite, kaolinite Silty - Hyper thermic- active- Clayey-Sanday, as well as some non-clay minerals, which included quartz and feldspar, which is calcareous. Difference in Class A Among these tissues families.

Based on the proposal of Al-Agidi (1976), four series, the DM55 tribute, were planted at the FAO site. They are a series of sedimentary soils originating from newly formed sediments of river origin. The soil body consists of two taxonomic layers with a thickness of 25 cm. the Placer is therefore given the number 5, and the second with a thickness of 100 cm included horizon C2,

which is alluvial tissue and given the number 5, and the internal drainage has a moderate (M) and shows spotting at a depth of 55 cm.

## Conclusions

1. The study pointed out that the soils of Iraq vary according to the prevailing climatic conditions, as well as characteristics of morphological, physical and chemical that all Bedonat study area dating back to the rank Entisol eight strings are TE955, DW57, TM1275, TM555, DW117, DM116, TI476, TM575 classified according to AL-Agaidi, 1976.

2. Remote sensing techniques are considered the best ways to gather information so as to the comprehensiveness provided by remote sensing data and shorten the time and effort to gather information, but it cannot be a substitute for the field survey, but these techniques give a true picture of the Mhhdalarda moment of capture.

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