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Geomatics Techniques Of Assessing The Land Cover Of Sehailiya Valley's Basin In Iraq

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Abstract

This paper aims at constructing relational maps by using GIS technology and lab analyses of selected samples of sand of the valley's basin in order to evaluate the degradation by depending on biological criteria to monitor the soil condition as well as monitoring the changes that occur on soil and vegetation and the spatial distribution of the soil. The soil was characterized by low salinity, medium and moderate light base and low value of organic materials. Its mixture was characterized by moderate and medium coarseness. The morphological analysis also showed the great variability in the area of the secondary valley's basins, which led to a variation in their water yield. It also had the advantage of not completing the geomorphological cycle because the basins are still in the youth stage and that the erosion process surpassed the deposition process.

1. Introduction

The resources that God Almighty has granted to humans are many, but the disparity between these resources directly affects living organisms and since soil is the vessel responsible for germination, therefore its study takes an important place in geographical studies from here the idea of the research came, as the research aims to determine levels of terrestrial viability The Sahli Valley, which is one of the valleys in the western Iraqi plateau, by analyzing the spatial variation of the soils in the region and the extent of their impact on the natural characteristics of different activities, which can achieve the optimal investment method for them by interpreting the variation of those soils and determining their salinity and texture as well as their chemical and physical properties. The importance of the findings of the research in assessing the level of ground capacity for the study area.

Research problem :

What is the role of R.S G.I.S technologies in the pedohydromorphometric analysis and evaluation of soil properties according to the approved international systems, and what are their suitability for the uses of the land?

Research hypothesis:

Analysis means fragmentation and division, and the analytical method is one of the modern research methods in natural geography, where modern technologies can explain and give detailed and quantitative information on the characteristics of the soil in the study area, thus facilitating the decision-makers to take any development plans in the field of investing these lands.

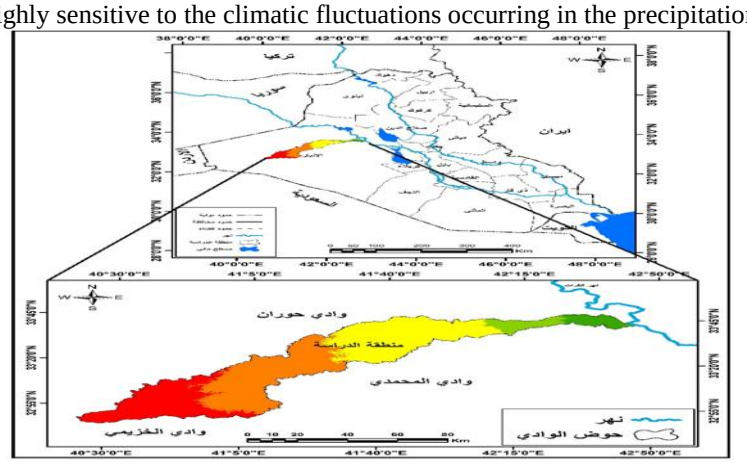
The method of work:

The pedological analysis process was carried out based on topographic maps at a scale of 1/100000, aerial images and satellite visuals from the 8Landsat satellite and the digital elevation model (DEM) with a distinct accuracy (30 × 30) using Arc Map 10.4.1 and Al-Adras 9.2 program for the Wadi Al-Sahlia by choosing soil models They are distributed along the valley and then analyze their physical and chemical properties of these soils through building cartographic models for them, as well as field study.

Search area boundaries:

The study area represents one of the valleys of the western Iraqi plateau and is located spatially in Anbar governorate on the right bank of the Euphrates River and its waters flow into it, and the map (1) shows its geographical location, as for its astronomical location, it is located between the two latitudes 32 ° 44'22 "N and

33 ° 48'15" N and longitudes 40 ° 23'4 "E and 42 ° 43'56" E, and this valley is characterized by being a temporary flow and highly sensitive to the climatic fluctuations occurring in the precipitation system.



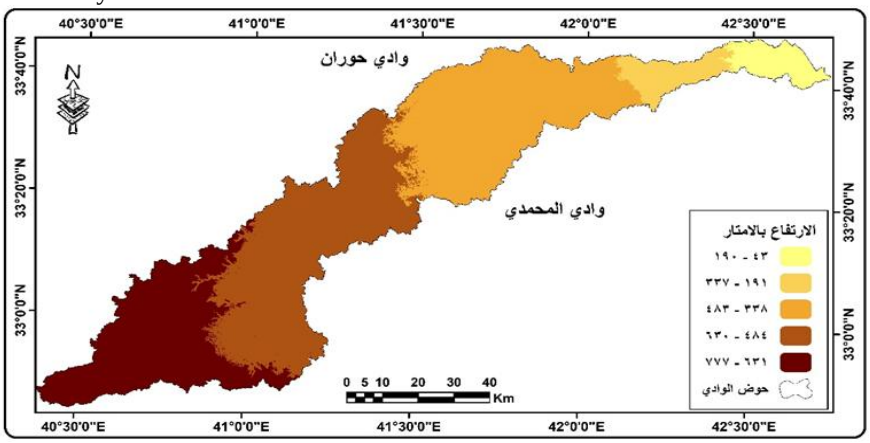
Source: based on:

- Republic of Iraq, General Survey Authority, Topographic Map of Iraq, for the year 1990, at a scale of 1: 100,000.
- The digital elevation model (DEM) with a distinct resolution (30 × 30). Arc Map 10.4.1.

First: Topographical Features:

1- Characteristics of height above sea level:

From the observation of map (2) and table (1), it is possible to notice the great variation in the elevation level of the study area, where the first category, which is the lowest, is recorded between (43-190 meters) above sea level, which is the area adjacent to the river valley with an area of 249 km2 A rate of (4.14%) of the total area of (6019) km2, which is the smallest area, and the next category came in height, which is higher than the previous category, as it recorded an amount of (191-337) meters above sea level and it occupies an area of (282) Km2, meaning that its percentage was (4.69%), and these two areas that were discussed only occupy a small part of the total area of the valley.



Map (2) The elevation ranges of the Al-Suhailiya Valley Basin

Source: Based on the digital elevation model (DEM), with a distinct accuracy of (30 x 30) meters And Arc Map 10.4.1 outputs.

Table (1) The elevation areas with the percentage of the Suhailiya Valley Basin

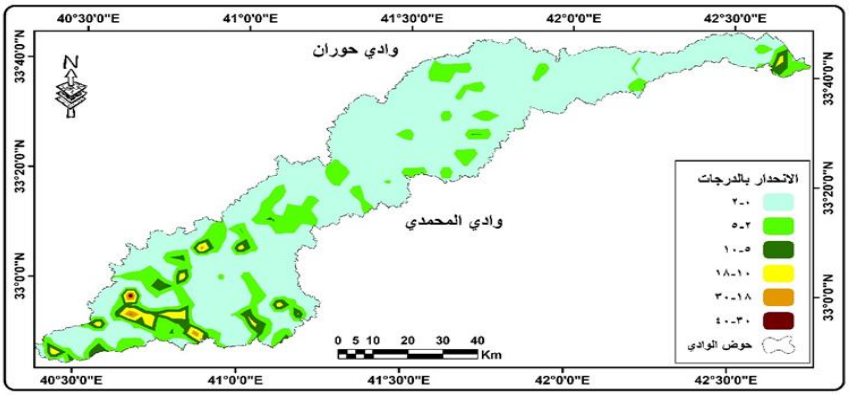
No.	Height classes	The area is 2 km	%
1	43 – 190	249	4.14%
2	191 – 337	282	4.69%
3	338 – 483	1912	31.76%
4	484 – 630	2100	34.89%
5	631 – 777	1476	24.52%
total	6019	100%	

Source: Based on Map (2), and Arc Map 10.4.1.

As for the third category, it constituted 31% of the area of the valley, as its total area was estimated at (1912 km2) and was represented in the area in the middle of the valley, but the fourth category was the largest area, reaching (2,100 km2), and this area constituted 34.89% of the total area of the valley. While the fifth

region, which represents the real beginning of the valley and the highest elevation, its area was (1476 km2), which is not a small percentage, reaching (24.52%).

2- The characteristics of the slope: Through the analysis of map (3) and table (2), we notice that most of the valley's lands are semi-flat, as the area of land between the two categories (0-2) reached a total of (4590), meaning (76.26%) of The total area .



Map (3) of the regression characteristics of the Al-Suhailiya valley
Source: Based on the digital elevation model (DEM), with a distinct accuracy of (30 x 30) meters
And Arc Map 10.3 program outputs.

Table (2) Classification of the slopes of the Al-Suhailiya Valley Basin according to the classification of Yonk

No	Degree of slope	The type of land slope	The area is 2 km	%
1	0 – 2	Semi-flat lands	4590	76.26%
2	2 – 5	Slope land	1095	18.19%
3	5 – 10	Slightly sloping grounds	240	3.98%
4	10 – 18	Land of moderate slope	80	1.33%
5	18 – 30	Steep terrain	13	0.21%
6	30 – 40	Very steep terrain	1	0.02%
total	6019	100%		

Source: Based on 1 - Girjis Dawood, the shape of the Earth's surface, applied gemophology, College of Education, Al-Mustansiriya University, University House for Printing, Basra, 2000 AD, pp. 123-124., Map (3), and Arc Map 10.4.1.

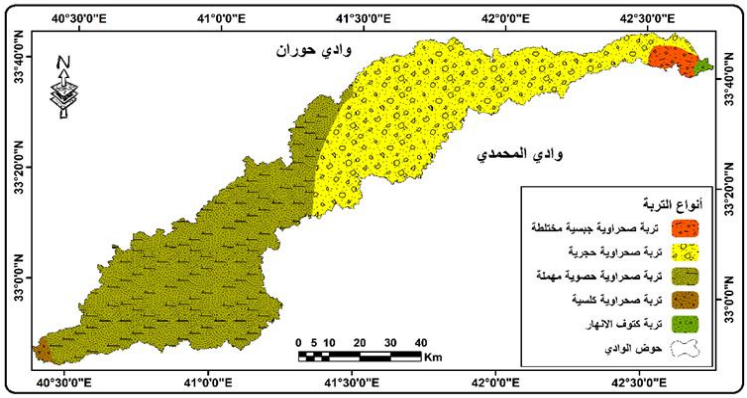
While the second category, which represents the slope (2-5), it occupied an area of (1095 km2) and its percentage (18.19%). These lands are characterized by being of simple slope. The third category represented by lands of light slope, which is the category (5-10), formed a percentage of (3.98%). Where it occupied an area of (240 km2), and the moderate slope category represented (10-18) area and amounted to (80 km2) constituting (1.33%) and the fifth category represented by the gradient (18-30) occupied a percentage (0.21%) to reach an area of (13 km2). These lands are characterized by their steep slope.

While the highest steeper categories came with the lowest areas, as it amounted to (1) km2 and by (0.02%) of the total area of the study area, its value ranged between (30 - 40) degrees, and these lands are characterized as very steep lands.

Second: Types of soils:

1- Stony desert soil:

This type is considered one of the second most widespread types of soils within the study area, Map (4), with an area of (2612) km2 and a percentage (43.40%) of the total area, Table (3), which is characterized by its permeability as it consists of sand, gravel and limestone, the thickness of which varies Between (20-25) cm.



Map (4) of the types of soils for the Al-Suhailiya valley

Buringh, Soils and Soil Conditions in Iraq Ministry of Agriculture, Baghdad, 1960, Map of Iraq, Scale 1: 1000000.

2- calcareous desert soil:

This soil is spread over a narrow area of the study area and occupies (34) km2 and its percentage (0.56%) occupies the far western edge of the study area. It is characterized by its high content of lime and sand ranging in thickness between (10-20) cm, and the reason for its lack of thickness It is exposed to erosion, which is one of the poorest types of soils in organic matter, which has affected the poor suitability for agricultural production.

3- Neglected desert gravel soils:

This type is considered one of the widest types of soils spread within the study area, as it extends from north to west towards the southwest, with an area of (3241) km2 and a percentage (53.84%) of the total area. 20-25) cm.

4- Mixed gypsum desert soil:

This soil is spread over an area of (111) km2 and its percentage (1.84%) occupies the far eastern end of the study area. It is characterized by containing a high percentage of lime and sand whose thickness ranges between (10-20) cm, and the reason for its lack of thickness is its exposure to erosion. Hydroponic due to its proximity to the river basin, and it is one of the poorest types of soils in organic matter, which affected its poor suitability for agricultural production

5- Soil of river claws:

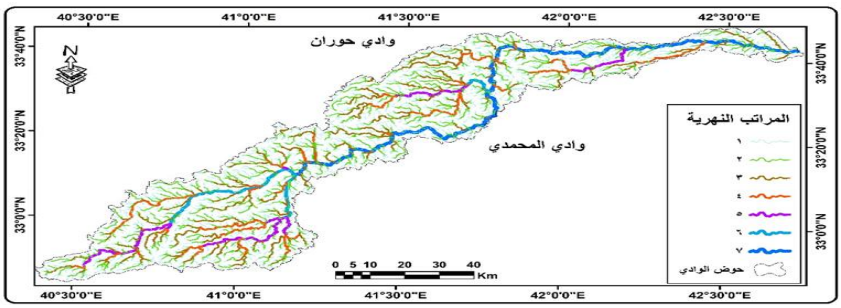
It occupies the least area of the study area compared to the rest of the aforementioned types of soils and is concentrated in the area overlapping with the mouth of the valley in the Euphrates River, where its area reached (21 km2), i.e. 0.35% of the total area of the valley.

Third: Water Resources:

This factor is one of the most important factors controlling agriculture and the possibility of land investment, as it shares with the soil in determining the nature

Height classes	The area is 2 km	%
Stony desert soil	2612	43.40%
Calcareous desert soil	34	0.56%
Neglected gravel desert soil	3241	53.84%
Mixed gypsum desert soil	111	1.84%
Soil of river claws	21	0.35%
total	6019	100%

This factor is one of the most important factors controlling agriculture and the possibility of land investment, as it shares with the soil in determining the nature of crops that can be cultivated in the study area, the water is represented in the running rainwater within the valley network represented by the main valley and secondary valleys, which can be relied upon to irrigate agricultural areas, Map (5) As for the second source, it is represented by groundwater, which is one of the main sources of agriculture in the desert lands that are far from the course of the Euphrates River, where groundwater is available in the study area in large quantities that can be exploited, especially those whose depths range between (200-250) m.

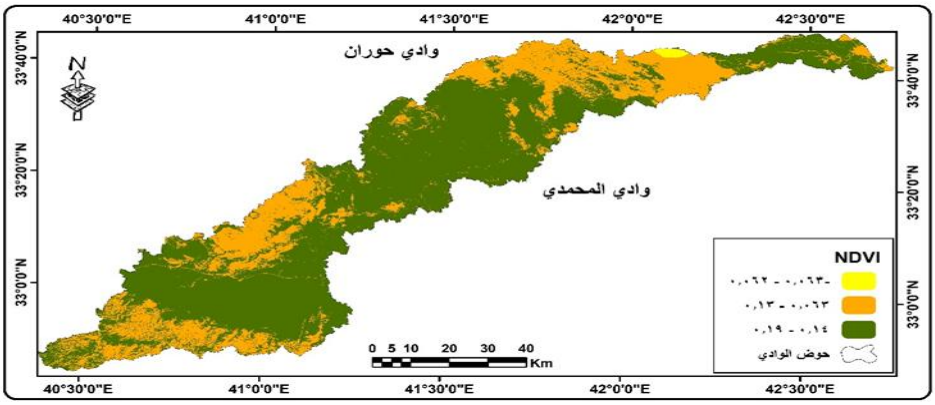


Map (5) of the water network of Al-Suhailiya valley
Source: Based on the digital elevation model (DEM), with a distinct accuracy of (30 x 30) meters
And Arc Map 10.4.1 outputs.

Fourth: Natural Plant:

Through map (6) and table (5), the density of natural vegetation cover in the study area was divided into three categories according to the value of (NDVI) ( ), as it is known that the value of (NDVI) ranges between (-1 and +1) Whenever the value approaches one, the higher the density of vegetation cover, and as it approaches zero or below zero, the less or no vegetation cover indicates.

Map (6) NDVI vegetation density of Al-Suhailiya Valley Basin
Source: LAND SATLC 8 satellite data, 9.2 Erdas Imagine software, and Arc Map 10.4.1 software.



Source: Based on Map (6), and Arc Map 10.4.1.

Table (5) NDVI values for Al-Suhailiya Valley Basin

Categories	The area is 2 km	%
-0.063 - 0.062	55	0.91%
0.063 - 0.13	1954	32.46%
0.14 - 0.19	4010	66.62%
total	6019	100%

We notice that the highest density of the vegetative cover of natural plants ranged between (0.14-0.19) distributed over different areas that make up an area of (4010) km2 with a rate of (66.62%), to occupy large areas, while the second category came, which is less widespread than the first category and is considered poor in its cover. The vegetable value ranged between (0.063 - 0.013), its area was (1954) km2, with a percentage of (32.46%), while the bad areas formed the lowest percentage and with a very small area of the study area, where the percentage did not exceed 091% and an area estimated at (55) km2.

Fifth: Laboratory Analysis:

In recent times, with the change in the ecosystem, the problem of soil degradation (Soil degradation) has emerged, which is one of the most important obstacles to agricultural expansion. Therefore, the research aims to evaluate the biological characteristics of the soil while evaluating its condition based on some biological criteria and remote sensing technologies and calculating the vegetative index coefficient (Normalized Difference Vegetation Index) for degraded soils, determining soil areas and preparing their maps with the help of geographic information systems software.

According to the results of laboratory analyzes of the soil's biological characteristics, it has been observed that there are types of physically degraded soils represented by soils affected by swollen and brittle salts and coarse sandy tissues in particular the sites of fixed and unfixed sand dunes resulting from wind erosion. The characteristics of the soil and thus its low productivity. The laboratory results will be analyzed in detail.

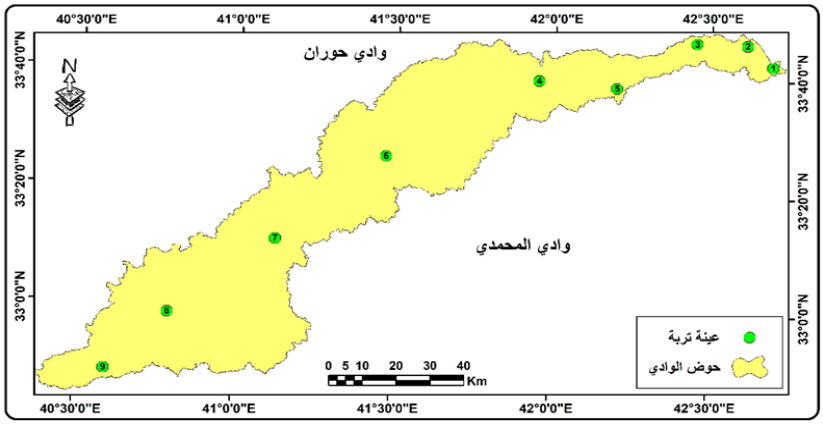
A number of samples were taken and for different places to determine the physical and chemical characteristics to determine the suitability of those soils for agricultural production. These samples cover the study area, which reached (9) and depending on the positioning system by GPS device as shown in Table (6) and Map (6) .

By relying on the results of the laboratory analysis of soil samples, models for each element were constructed in the form of maps to show the extent of the variation in the proportions of each element within the study area, depending on the GIS programs.

Table (6) Results of laboratory analyzes of selected samples from the soils of the Wadi Al-Suhailiya Basin

Soil sample	Limestone	Gypsum	sand	Greene	Clay	cEc	Ece	Ph	depth
1	28.1	0.5	24.7	71.1	4.03	20.7	7.7	7.9	20
2	53	0.6	41	46	13	14	2.8	7.8	10
3	33	0.3	37	46	17	17.4	0.7	8.2	20
4	39	0.3	3	50	18	12.8	2.2	7.6	12
5	36	0.8	25	48	27	12	6.6	7.5	31
6	46	2.8	32	46	22	14	7.2	8.1	20
7	36	0.8	39	48	13	15	2.5	7.7	18
8	34	0.4	25	57	18	15.5	7.4	7.9	10
9	40	3.2	36	43	21	15	0.9	7.6	18

Source: Based on soil analysis laboratories.

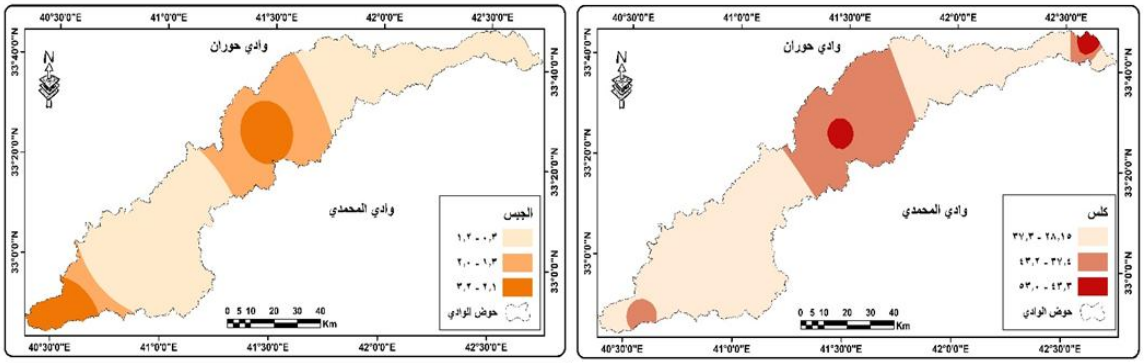


Map (6) of soil sample selection sites for Al-Suhailiya Valley Basin

Source: Republic of Iraq, General Survey Authority, Iraq Topographic Map, for the year 1990, at a scale of 1: 100,000, the field study.

And based on the results of the analysis, it was found that the highest value of lime was between (53-28.1%), and this discrepancy is clear and large, as these soils are characterized by being of poor or non-existent organic materials and characterized by the abundance of mineral substances resulting from the lack of washing process due to the scarcity of rain. Map (8) .

While the percentage of gypsum presence ranged between (3.2 - 0.8%), and for the optimum utilization of lands that contain a high percentage of gypsum, wells should be dug and used in agriculture, and the cultivation of grains is considered the most suitable for those lands, map (9).

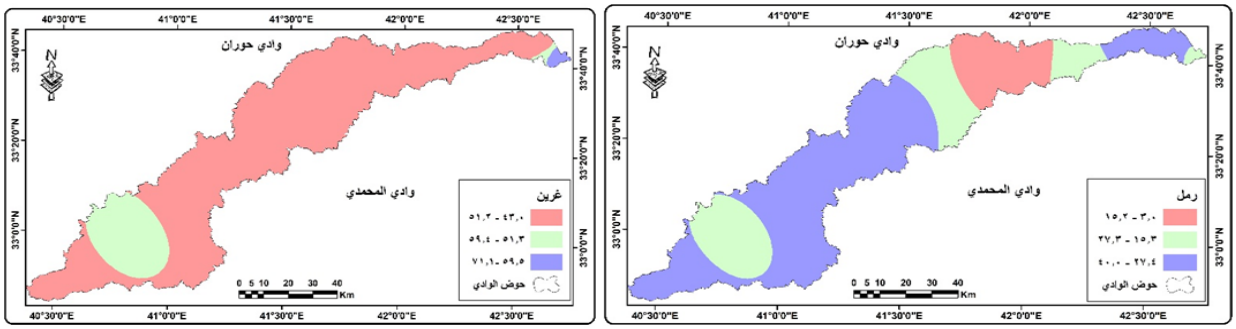


Map (9) The percentage of gypsum for soils in the Wadi Suhailiya basin **Map (8)** Lime ratio for soils in the Al-Suhailiya Valley Basin

Source: Based on Table (6), and the outputs of Arc Map 10.4.1.

While the percentage of sand varied widely, where its presence ranged between (41 -3%), with the lowest percentage concentrated in the fourth sample. These soils are best suited for practicing agricultural activity and are also distinguished by being in the youth stage permanently. Map (10)

As for the silt separator, the highest value of its presence ranged between (71.1 - 57%), which is a high percentage, especially if we know that the lowest value for its presence was recorded (43 - 46%), Map (11).

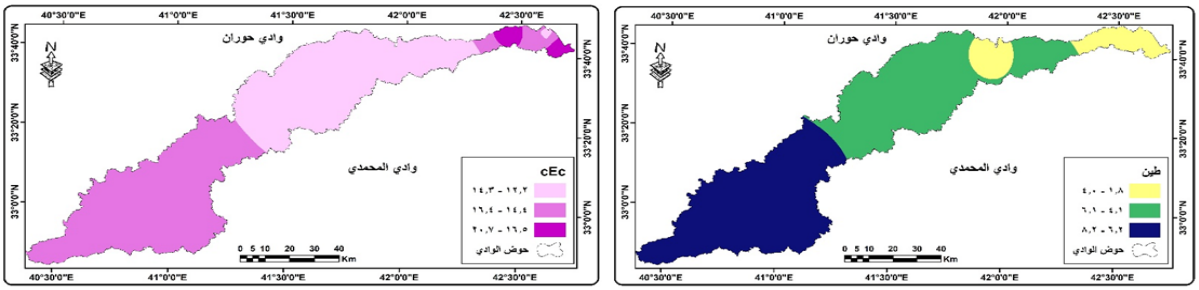


Map (10) The ratio of sand to soils in the Wadi Suhailiya basin **map (11)** The ratio of silt to soils in the Wadi Suhailiya basin

Source: Based on Table (6), and the outputs of Arc Map 10.4.1.

While the percentage of mud was recorded between (27 - 4.3%), to record its lowest prevalence in the eastern shore near the Euphrates River, and it is characterized by its shallowness and its lack of spread. Map (12).

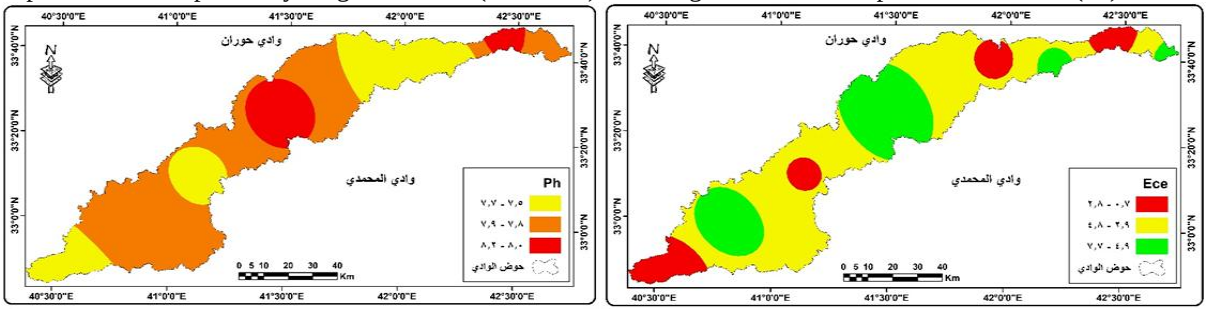
As for the cation exchange capacity (CEC) (ds / cm-1), its values ranged between (20.7 - 12) in texture. The CEC increases with the fineness of the grains. In heavy clay soils it is higher than light sandy soils. Map (13).



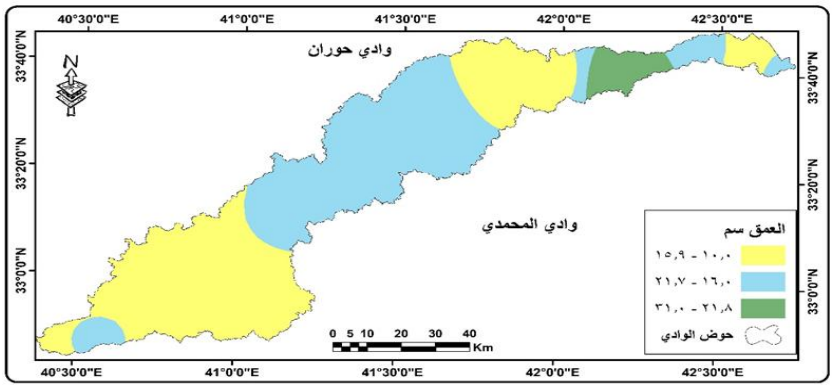
Map (12) The salinity value (mud) of the soil in the Wadi al-Suhailiya basin **Map (13)** the salinity value (CEC) of the soil in the Wadi al-Suhailiya basin

As for the degree of salinity (Ece) (ds / cm-1), it ranged from (7.7 - 0.7%), and these percentages increase with the presence of lime, so it is preferable to treat lime melt to reduce these percentages, Map (14).

As for the value of the pH or acidity (PH), we find that its values ranged between (8.2 - 7.6%), which is a chemical characteristic that plays an important role in many of the soil's physical, chemical and biological properties, and on the basis of which the soil is classified tilted to basic or acidic, especially if we know that The degree of parity between them is (7), so it can be said that most of the soils are basic, map (15). As for the depths of soil samples, they ranged between (10-31 cm), meaning that all soil samples were shallow (16).



Map (14) The salinity value (Ece) of the soil in the Wadi Al Suhailiya basin **Map (15)** The salinity value (PH) for the soil in the Wadi Al Suhailiya basin
Source: Based on Table (6), and the outputs of Arc Map 10.4.1.



Map (16) soil depths / cm in the Al-Suhailiya Valley Basin
Source: Based on Table (6), and the outputs of Arc Map 10.4.1.
Sixth: assessing the level of ground capacity:
In order to determine the optimal use of the land while preserving the soil without exposing it to degradation processes in order to ensure the achievement of the sustainable development process, this research relied on a set of ground indicators for the Wadi Al-Suhailiya basin, which through its results were determined the degrees of ground suitability based on the classification established by the Conservation Department Soil in the United States of America in 1961 with eight levels.
These indicators included the nature of the valley's topography, including height and slope, and the physical and chemical properties of the area's soil, as well as the natural plant distribution in the study area, as shown in Figure (1).

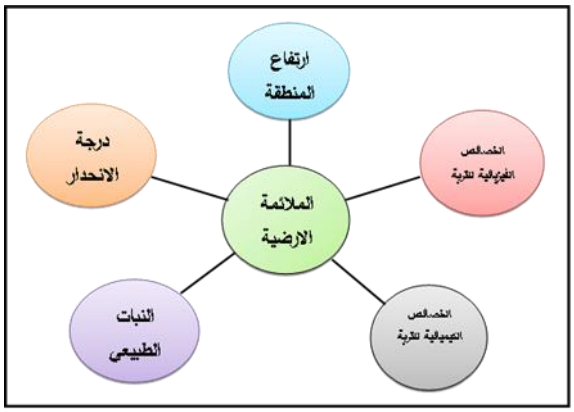
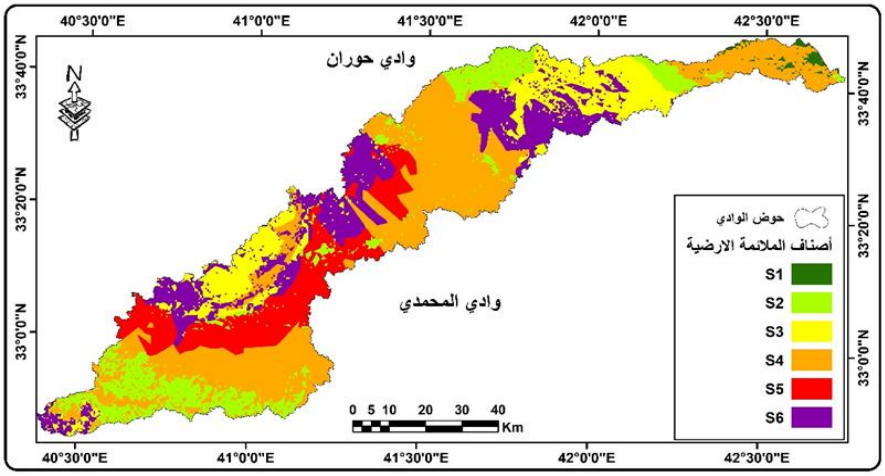


Figure (1) Topographic indicators to assess the level of terrestrial viability of the Al-Suhailiya Valley Basin
Source: Credited with Arc Map 10.4.1.
Based on the above, different levels of suitability for the soils of the Sahliya Valley were identified and the most important determinants that prevent the optimal use of those soils, in addition to the requirements, as the study showed six sections distributed in different areas.
Through the map (17) and table (7), the presence of six levels distributed in different areas, the fertile lands of the first level recorded limited areas that do not exceed 42 km2 with a ratio of 0.7% of the total land area, and it does not require more than regular management to exploit them scientifically.



Map (17) levels of soil suitability for the Al-Suhailiya Valley Basin
Source: Based on Map (2, 3) and Arc Map 10.4.1

Table (7) Soil suitability levels for the Al-Suhailiya Valley Basin

Item	Code	Determinants	Usage requirements	Validity	Space	%	Fit ratio
the first	S1	Soil fertility	Regular management	For dense cultivation	42	0.7%	1 – 8
The second	S2	Soil type	Specific maintenance and management	For planting and grazing	830	13.8%	2 - 6
the third	S3	Soil type and depth	Extensive maintenance and management	For grazing and agriculture limited	890	14.8%	3 - 5
the fourth	S4	Soil type, depth and salinity, with rocky openings	Very intensive maintenance and administration	For limited grazing	2316	38.5%	4 – 4
Fifth	S5	The type of rock discoveries, erosion and sedimentation processes	Experience and high economic cost	Housing, tourism industry and other uses	862	14.3%	5 – 4
VI	S6	Type of rock discoveries, erosion and sedimentation processes, groundwater work activity, and high salt content	Experience and economic cost is very high to impossible	Housing industry and tourism in a limited way with other uses	830	13.8%	6 – 3

Source: Based on Map (17), and Arc Map 10.4.1.

While the percentage of the second level was the largest area by 13.8% of the area of the valley with an area of 830 km2, and these soils need specific maintenance and management in order to exploit them to achieve economic feasibility and benefit those lands for agriculture and grazing. Soil is the main challenge in its exploitation, as it needs intensive management to obtain the greatest benefit from those soils. As for its exploitation, it lies in grazing and limited agriculture, and it occupies an area of 890 km2 with an area of 14.8%. While the fourth level recorded the largest area of the study area at a rate of 38.5%, that is, an area of 2316 km2, which is a large percentage, especially if we know that these soils suffer from a set of problems and limitations that prevent their exploitation. Perhaps the type and depth of the soil and the degree of salinity with the presence

of rock detectors and they need to Very intensive maintenance and management to prevent it from being left behind.

As for the level section, with an area of 862 km2 and occupies 14.3% of the total area of the valley, this section suffers from problems that may make its exploitation almost impossible, or it needs experience and a great economic cost, even if it is available, it does not achieve the economic feasibility of its exploitation and comes at the forefront of these problems the emergence of rock detectors And the activity of the process of erosion and sedimentation

While the sixth level, which constitutes 13.8% with an area of 830 km2, can be used for housing, industry and tourism in a limited way with other uses, as it is not suitable for agriculture due to the type of rock discoveries, erosion and sedimentation operations, groundwater work activity and the high rate of salts, which may require experience and a very high economic cost. .

Results and recommendations

Results:

1- The research revealed the variation in the topography of the Al-Suhailiya Valley Basin between (43-777) meters above sea level, while the lands occupied semi-flat lands with the highest areas of slope by about (4590) km2, or (76.26%) of the total area of the valley.

2- The research showed that neglected gravel desert soil came with the largest soil area with (2612) km2 and a percentage (43.40%), while the river claw soil came with the lowest soil types with (21) km2, which is equivalent to (0.35%) of the total basin area of the valley.

3- The research showed that the highest density of vegetative cover (NDVI) ranged between (0.14-0.19), which formed an area of (4010) km2, a rate of (66.62%) of the total area of the valley basin.

4- The study showed six levels according to the suitability of the soil distributed in different areas, where the fertile lands recorded limited areas not exceeding (42) km2 by (0.7%), while the fourth level recorded the largest area of the area of the study area by (38.5%) i.e. an area (2316 km2) Of the total land area, which is lands that need extensive maintenance and management.

Recommendations:

1- Using modern geographic techniques with survey studies of soils and determining the most appropriate activity for them, as they give high accuracy and speed of completion, provided that they are compatible with the field survey.

2- In order to increase the production of the soils in the study area, their characteristics must be improved through the use of organic fertilizers and the selection of types of seeds that have the ability to resist conditions in the study area.

3- Adopting modern methods of irrigation of agricultural lands by determining water rationing for each type of crop to maintain the permanence of production and optimum utilization of those lands.

References

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