ISSN: 2458-8989

Natural and Engineering Sciences

NESciences, 2024, 9 (2): 426-440 doi: 10.28978/nesciences.1574447

The Impact of Climatic Characteristics on Increasing Soil Salinity in Manathira District Center

Samer H. Kadhim Al-Jashaami [1*], Safaa M. Almudhafar [2], Basim A. Almayahi [3]

[1*] Faculty of Physical Planning, Urban Planning Department, University of Kufa, Najaf, Iraq.
E-mail: samer.khidhr@uokufa.edu.iq

[2] Department of Geography, Faculty of Arts, University of Kufa, Najaf, Iraq.
E-mail: safaa.almudhafar@uokufa.edu.iq

[3] Department of Physics, Faculty of Science, University of Kufa, Najaf, Iraq.
E-mail: basim.almayahi@uokufa.edu.iq

Abstract

The climate plays a crucial role in shaping soil characteristics. High temperatures during summer can lead to increased evaporation of soil moisture, resulting in drier and more fragmented soils. This process often leads to higher salt concentrations, altering the soil's properties. In the study area, the soil is categorized into four types: river shoulder soil, river basin soil, riverine island soil, and desert gypsum soil. These soil types are significantly influenced by environmental factors, both natural and anthropogenic. Soil, being a fundamental component of the environment that supports life, is essential for the survival of humans, plants, and animals. In the Najaf Governorate, the soil is vital for agriculture, supporting the growth of various important crops, including vegetables and fruits. However, the soil's natural and human-induced changes have led to a noticeable deterioration in its quality, rendering much of the land unsuitable for agriculture due to high concentrations of saline elements. The natural factors impacting the soil in the study area include climate, soil properties, and water resources, while human activities have further exacerbated these effects. As a result, the soil, particularly in cultivated and uncultivated basins, has seen a rise in the levels of total dissolved salts, sodium, magnesium, calcium, potassium, sulfate, and chloride, often exceeding global standards. In contrast, the soils of river shoulders have remained within acceptable limits.

Keywords:

Properties, high temperatures, the soil of the area, environmental impacts, salt concentrations.

Article history:

Received: 28/06/2024, Revised: 24/08/2024, Accepted: 20/09/2024, Available online: 30/10/2024

**Corresponding Author: Samer H. Kadhim Al-Jashaami, E-mail: samer.khidhr@uokufa.edu.iq*

Introduction

Soil is a vital natural resource that serves as the foundation for all living organisms, providing essential nutrients and a habitat. It is a complex natural formation created through intricate mechanical and chemical processes involving elements from both the Earth's surface and shallow subsurface. Geographers study soil due to its fundamental importance and relatively recent focus within the field. Soil is defined as a natural entity with both depth and surface area, playing a critical role in the environment (Al-Mudhafar, 2007; Ministry of Water Resources; Arq Gis; Hussein, 2017; Ministry of Agriculture). Soil is one of the most important environmental resources on which all living organisms live, and it is an evolved natural body with physical and chemical characteristics (Radmanović et al., 2018). The soil in the study area is diverse, encompassing river shoulder soils, river basin soils, riverine island soils, and desert gypsum soils. These soils, part of the sedimentary plain, have been significantly impacted by both natural and human environmental factors, leading to elevated salt concentrations. As a result, some soils have deteriorated and become unsuitable for agriculture (Llopiz-Guerra et al., 2024; Angin et al., 2020). The natural factors influencing soil characteristics include surface features such as elevation and slope (Donahae, 1980; Directorate of Population Statistics in Najaf Governorate; Almudhafar, 2020). The low-lying areas were greatly affected by the high concentrations of salts and the high level of groundwater, as is the case in the soil of river basins compared to the soil of river basins. The climatic environment of the study area, represented by high temperature and extreme evaporation during the summer, has affected the characteristics of the soil and made it dry experience on which the salts are concentrated (Almudhafar, 2018; Almudhafar & Abboud, 2018; Almudhafar & Alattabi, 2019). The irrigated surface water of agricultural land has a negative impact, as it contains concentrations of salts and also human environmental factors have a negative role in influencing the characteristics of the soil through its various activities, represented in the dumping of household waste, random housing or its wrong agricultural activities, all factors affected the characteristics of the soil (Kadhim et al., 2023; Safaa et al., 2020; Abdil-Ameer et al., 2022; Abyss et al., 2022; Kadhim et al., 2023; Noor et al., 2023; Wahhab et al., 2023). It is also known that the study area is one of the various agricultural areas with its agricultural production, where grain crops, vegetable crops and fruits of all kinds are grown (Nabeesab Mamdapur et al., 2019; Safaa et al., 2023; Safaa et al., 2023; Safaa et al., 2023; Hassan et al., 2023; Safaa et al., 2024; Samer et al., 2024; Al-Jashaami et al., 2024; Hussein, 2017; Radhika & Masood, 2022; Safaa et al., 2023; Alattabi).

1. What is the impact of climatic characteristics on increasing the percentage of salts in soil?
2. How is the spatial variation of saline elements in a soil?

Hypothesis of the Study

1. Climatic characteristics play an important role in the high concentrations of salt elements in the soil of the study area.
2. Concentrations of salt elements vary from one soil to another following nature of the factors affecting them.

Objective of the Study

The study indicates the impact of climatic characteristics on the high concentrations of salts in the study area, in addition to knowing the spatial variations of the high salt concentrations from one soil to another in order to identify this problem and develop solutions and proposals to address this problem.

Limits of the Study Area

The center of Al-Manathra district is located in the north of Najaf Governorate. Its borders extend between the longitudes (-48 43 -28 44 East) and latitudes (-48 43 -28 44 North). Fig. 1 has an area of (49.71) km^2, forming a shape closer to the triangle. As for the geographical location, the area is bordered to the north by the center of Kufa district, to the south by the center of Mashkhab district, to the east by the administrative borders of Qadisiyah governorate, to the southeast by the center of Mashkhab district, to the west by Al-Hirah governorate, and to the temporal borders.

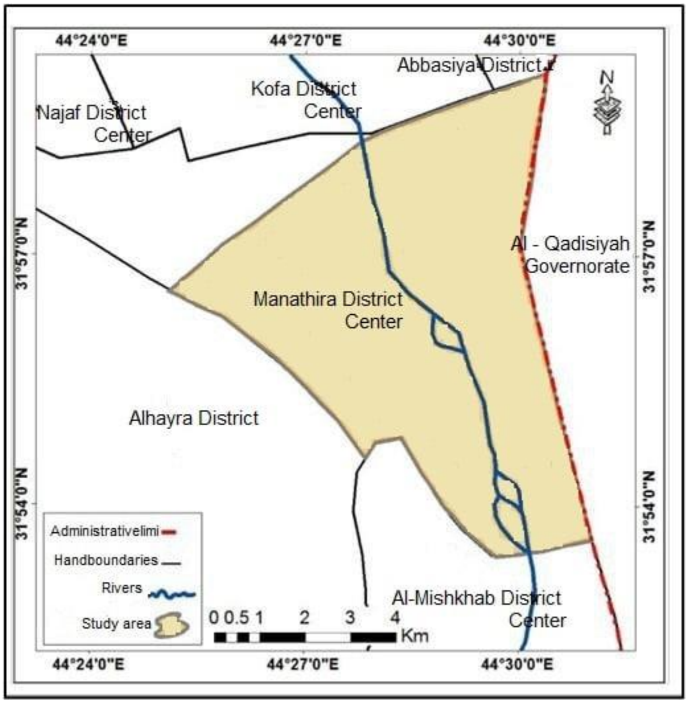

Figure 1. Manathira district center map

Materials and Methods

Environmental Assessment of Soil in Study Area

- The environmental assessment of the Al-Harfiyyin neighborhood area is represented by analyzing the chemical elements of soil and includes the sampling sites, as (Arq Gis) samples were selected and collected from different sites based on the field survey of the area as well as the random method and the sites as follows:
- River Shoulder Soil (s1)
- River Basin Soil (s2)
- Cultivated Desert Soil (s3)
- Cultivated Desert Soil (s4)

Devices Used in Soil Analysis of the Study Area

1. A device (starter ohaus) to measure the degree of interaction (pH).
2. Multimeter (senso Direct) for measuring electrical conductivity (EC).
3. The flame photo meter is of English origin for the purpose of measuring magnesium-sulfate-calcium.
4. German spectro photo meter established for the purpose of measuring heavy elements.

The Method of Work

The work in conducting chemical tests of the soil was based on a number of field and laboratory methods that can be clarified as follows:

1. **pH:** A device (stractor ohaus) was used to measure the hydrological index after calibrating it with a planck device and neutral distilled water, as a mixture was made for each sample and then the mixture was shaken well and the filtration process was carried out on it and the filter paper was placed on the decanters in which the samples were distributed, so the net is taken after its filtration and then the reading is taken for it.
2. **(E.C)):** A (flame photo meter) device was used to measure the electrical connection, as four samples were taken and a mixture was made for each sample, and the mixture was shaken well and then filtered before taking the reading through the filter paper for each sample taken, then the net of the filtration was taken and the reading was taken for it.
3. **Calcium - Magnesium - Sulfates:** A device (flame photo meter) of English origin was used in the method of flammable atomic emission and distilled water and solutions were used to measure the existing ions for the purpose of measuring after crossing the device with a standard solution. The sample was placed in a baker with a capacity of (100mm) below the device tube and then the device is turned on if 5ml of the sample was taken in a baker with a capacity of (100 ml) with 10 ml of distilled water. Then 5ml of solution water was added with 2 drops of bicarbonic acid and the solution is quietly shaken until it turns orange and then the correction begins with (EDTA) until the color begins to change to blue and then the reading is taken and the results are expressed in mg/liter (Figs. 2, 3).

Figure 2. Preparing Samples

Figure 3. Laboratory equipment’s

Study Structure

The study was divided into:

1. Climatic characteristics affecting the increase in soil salinity of the study area
2. Evaluate the saline elements in soil
3. Results

First: Climatic characteristics affecting increase in salinity of the soil of Al-Manathira District Center.

The climate elements affect the characteristics of the soil directly and the characteristics of the climate reflect the quality of the soil and its characteristics in the study area. In order to know the climatic characteristics affecting the soil, the climatic data must be analyzed as follows.

1. Temperature

The annual average temperature in the study site was (25.6m) (Table (1)). They reach the highest in July at a rate of (38m) and then their rates decline to reach the lowest in January (11.3m). A high daily and annual temperature range is observed. It should be noted that high temperatures, during the hot summer month, lead to high evaporation from the surface of the soil, which exposes it to drought, disintegration, ease of atomization, transport and change of its characteristics, and thus also leads to the process of soil desertification, cracking and the rise of saline elements.

2. Winds

The annual average wind speed is (1.9m/s) as wind movement in the study area is active in the summer season to record the highest rate in the hot months (June-July) at rates of (3.0-2.8 m/s) respectively while wind speed is lower than these rates in the cold months to reach the lowest in November and December (1.2-1.1m/s) respectively (Table (1)). In the summer, the winds increase the evaporation values and expose the soil to drought, disintegration and easy transfer, which leads to negatively in its natural characteristics such as low moisture content and lack of thickness. The winds also change the chemical, physical and biological properties of the soil significantly and contribute significantly to the rise of the saline elements.

3. Dust Storms

The annual average of dust storms is (4.3 storms), as the highest rate of dust storms was recorded in April (4.3 storms) and the lowest rate was recorded in September (0.02 storms) (Table (1)). The annual total of rising dust is (47.3days), when the highest frequency of the phenomenon of rising dust was recorded in June and July (1-8.2 days), respectively, as a result of high temperatures, increased drought and wind speed, while the lowest rate was recorded in December (0.6days), while the annual total of the phenomenon of suspended dust was (62.2days). The frequency of this phenomenon increases during the summer months, as the maximum rate was recorded in March (9.7days), while the lowest was recorded.

Table 1. Climatic characteristics of the study area for the period (2017-2023)

Month	Temperatures °c	Wind speed m/s	Dust storms d/y	Relative humidity	Rain mm	Evaporation mm
Jan.	11.3	1.2	0.3	70.3	17.6	93.1
Feb.	14.2	1.8	0.2	575	16.5	131.1
Mar.	18.3.	2.9	0.8	54.1	13.0	217.1
Apr.	25.7	2.2	0.1	44	12.4.	302.2
Mar.	30.9	3.0	0.6	33.1	13.9	426
Jun.	35.5	2.8	0.4	27.8	4.5	550
Jul.	38	2.3	0.3	23.3	0	593
Aug.	37.5	1.7	0.01	34.3	0	.567
Sep.	33.8	1.1	0.02	29.8	0	409
Oct.	28.6	1.2	0.2	41	0	285
Nov.	19.6	1.1	0.2	57.2%	2	160-2
Dec.	13.4	1.1	0.2	68.5	10.9	97.2
Annual Total	-	-	4.3	-	91.4	8
Annual Grade	25.6	1.9	-	44.2	-	-

Public Authority for Weather and Seismic Monitoring in Iraq. Climate Department 2023.

Taka rate in November and December (2.6-0.3days) respectively. Dust storms have a great impact on changing the physical, chemical and biological properties of the soil and then transferring the surface layer of the soil, which causes its deterioration when the wind speed increases, overcoming the force of friction, which exposes the soil to drought, disintegration and high salt content.

4. Relative Humidity

Table 1 shows that the annual average humidity in the study area was 44.2%, with significant monthly variations. The lowest humidity levels were recorded during the summer months of June, July, and August, at 27.8%, 23.3%, and 24.3%, respectively. In contrast, the highest humidity levels occurred during the cold winter months of December, January, and February, at 68.5%, 70.3%, and 57.5%, respectively. The drop in relative humidity during the hot summer months, coupled with rising temperatures, leads to moisture loss and increased soil dryness. This makes the soil more prone to disintegration and susceptible to transport by wind and storms, which alters its physical and chemical properties.

5. Rain

Table (1) shows that the total annual amount of rainfall was (91.4mm). The rainfall rate varies as it reaches its highest amount in December at a rate of (17.7mm) and then begins after this month to decrease to reach its lowest in May (4.8mm), after which the rainfall stops in June, July, August, and September, which are considered dry months. As it is known that the rain of the study area is low fluctuation in its fall, it may fall suddenly and quickly, which soil is at risk of erosion, which can lead to the loss of organic and mineral content and alter its physical, chemical, and biological properties. Additionally, the soil may lose salts and harmful elements through leaching. Prolonged dry periods or minimal rainfall reduce soil moisture, making it more susceptible to wind erosion.

6. Evaporation

Table (1) shows that the average amount of evaporation is high (3883.8 mm). Evaporation rates vary monthly, reaching a maximum in July at a rate of (593mm). This is due to high temperatures, low relative humidity and little or no clouds, while the maximum in January is at a rate of (93.1mm). This is due to low temperatures, high relative humidity in the atmosphere and increased clouds. This shows that the soil is exposed to drought, disintegration and desertification as a result of increased heat, lack of rainfall and high evaporation factor. This negatively affects the soil and changes its physico-chemical properties. Low evaporation rates result in higher soil moisture, enhancing its cohesion and leading to increased leaching. This process, in turn, raises salt concentrations in the soil.

Soil Features

The study area contains four distinct soil types, as shown in Figure 4: river basin soil, flooded river island soil, mixed desert gypsum soil, and river shoulder soil, each with its own specific characteristics.

River Basin Soil

These soils are located in the northeastern section and occupy an area of (21.71) km^2, of the study area is a map (3), and the soil is of mixed alluvial tissue according to the soil weaving triangle Table (2) (3), due to the high percentage of alluvium in it reached (69.56%), while the percentage of sand reached (13.71) and the percentage of clay reached (16.73%) and is considered one of the soils with high porosity, as it reached (40.83%). Table (4), while the percentage of permeability was (0.34 m/day) and it is considered one of the soils with a slow abundance rate if it reached (0.20%). Tables (5, 6) is seen in it. As for the percentage of organic matter, it reached (0.19%) and this is due to the sedimentation processes that the riverbed is exposed to Table (3).

Flooded Riverine Island Soil

This soil type covers a small portion of the study area, specifically in the middle of the river, spanning 0.75 km^2, as shown in Map 3. It is primarily found on the islands within the Euphrates River, particularly along the Shatt Al-Kufa branch. This soil is characterized by having a mixed alluvial tissue according to the triangle of tissue Table (2, 4), because of the high percentage of silt in it, reaching (77.20%), and the percentage of sand in it reached (12.80%), while the percentage of clay is (10.00%), and it is considered a soil with high porosity, reaching (40.2%), and it is considered to have a medium-slow permeability. Table (3) as the permeability ratio reached (0.32m/ day). Table (6) and it is a soil with a very slow permeable rate looking at Table (5), reaching (0.28 cm/ h), and it is considered to be poor in organic matter, where the percentage of organic matter reached (0.16%) Table (3).

Mixed Gypsum Desert Soil

These soils are located west of the study area and occupy an area of (19.19) km^2. It extends in the form of a triangle and has a mixed sand texture with a sand percentage of (65.42%) according to the tissue triangle Table (2).

The percentage of silt was (15.60%), but the percentage of clay was (18.98%), and it is considered one of the soils with high porosity, as its percentage reached (42.12%), which is seen in Table (3). As for its permeability, it reached (0.32 m/ day), where the soils are considered to have slow average permeability, according to the criterion, which is seen in Table (5), while the percentage of water in them rose to (0.44cm /

hour), it is considered to have a slow tip rate, which is seen in Table (6), and the percentage of organic matter in it reached (0.23%).

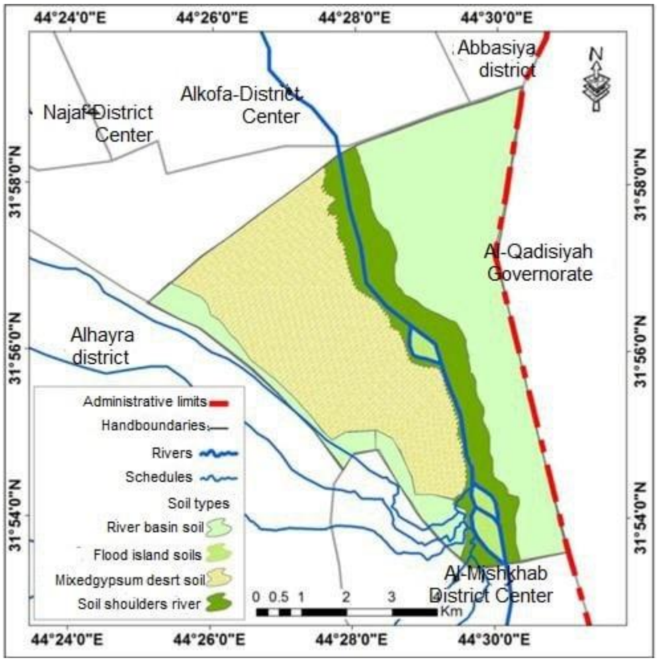

Figure 4. Types of soil in the study area

Table 2. Results of physical analyses of soil separators

Specimen Name	Sand	Silt %	Mud
Pond soil	13.71	69.56	16.73
Katuf soil	67.65	10.50	85 21
Desert soil	65 – 42	15.60	18.98
Flood Island soil	12.80	77.20	10.00

Table 3. The results of the physical analyses of the soil

Specimen Name	Porosity (%)	Permeability m/ day	Tender rate cm/ h	Organic matter
Ponds Soil	40.83	0.34	0.20	0.19
Flooded riverine Island soil	40.2	0.32	0.28	0.16
Gypsum desert soil	42 - 12	0.32	0.44	0.23
soil	41.75	0.32	0.44	0.22

Table 4. Classification of soil type according to its components and texture according to the international classification of American Salinity Lab (Hussein, 2017).

S/N	**Soil Components**	**soil quality**
1	58% or more of sand	Sandy
2	70%-85% sand, 30% silt and clay	Blended Sandy
3	7% clay, less than 50% silt, 43-52% sand	Sand mix
4	7-27% of clay, 28-50% of silt, and less than 52% of sand	Blend
5	50% or more of silt and12 - of clay	Alluvial mixtures
6	80% or more of silt Less than 12% of clay	Alluvial
7	20-35 of clay and less than 28% of silt and 45% or more of sand	Sandy clay mixtures
8	27-40% clay and 20-45% sand	Clay mixtures
9	27-40 clay and less than 30% sand	Alluvial mixtures
10	35% or more mud and 45% or more sand	Sandy clay
11	40% clay and 40% silt	Alluvial clay
12	40% clay, less than 45% sand and less than 40% silt	Mud

Table 5. Average speed of water tip in the soil (cm/ h) according to the standard (National coopratira soil survey-1972) (Donahae, 1980).

Tender rate cm / h	Soil Class
Less Than	Very slow
0.25-1.25	Slow
1.25-2.5	Medium
More than 2.5	Rapid

Table 6. Evaluation of soil on the basis of its permeability (m/ day) (1954 USDA) (Almudhafar & Alattabi, 2019).

Permeability m/ day	Soil type
Less 0.05	Very slow
0.05-0.30	Slow
0.30-0.80	Moderately Slow
0.80-3.5	Rapid Moderately
3.5.10	Rapid
More than 10	very fast

River Shoulder Soil

This soil extends in the form of a strip with the extension of the river in the study area and occupies an area of (4.97) km^2map (3), and it is a soil with a mixed sandy texture according to the textile triangle of Table (4), where the percentage of sand was (67.65%), and the percentage of clay was (21.85%). As for the percentage of silt (10.50%), it is one of the finest types of soil suitable for agriculture, and its porosity was (41.07%), while its permeability ratio was (0.32 m/ h). It is one of the soils with a slow average permeability. Table (5) looks at the rate of water tip between its molecules was (0.44 cm/h), so it is one of the soils with a slow rate according to the standard. Table (6) is considered, and the percentage of organic matter was (0.22%). This is produced through the sediments brought by river water and the organic matter it carries.

Water Resources

The water resources in the study site were represented by rainwater and surface and groundwater, and the climatic characteristics were previously studied in the center of Manathira district, and it was found that the dry desert climate prevails and that the amount of rainfall is small, and its impact is limited to surface water only in the seasons of its fall, so surface water, which is the main source of water in the study area, was relied on, in addition to the use of groundwater, which is an available storage that can be used in times of surface water shortage, and water resources in the study area are as follows:

Evaluation of Saline Elements in Soil

The saline elements were studied in the soil of the study area by four different sites and in the random in-kind method intended for my agency.

1. Basal and Acidic (pH)

It appears from Table (7) that there is a spatial variation in the values of (ph) for the studied sites, and their values ranged from (7.1-7.9). When comparing these sites with the global standard Table (8), we note that they are within the moderate basal soil.

2. Electrical Conductivity (Ec)

It is noted from Table (7) that the electrical conductivity concentrations are spatially different in their concentrations for the studied sites. The lowest concentrations were at the sites (s1) and (s4), amounting to

(2.4) (2.1) dBsmens/m. Table (7) is within the permissible limits. The highest concentrations appeared in the second site, the river basin soil (s2), with a concentration of (14.2) dBsmens/m. Table (9), it was found to be very high salinity. The site (s3) has a concentration of (5.3) dBsmens/m. This site is considered to be of medium salinity.

3. *Total Dissolved Salts (T.D.S)*

It is clear from Table (7) that the concentrations of total dissolved salts are spatially different in the studied sites, as it was noted that the sites (s1 - s3 - s4) are of medium salinity according to the international standard Table (10), where their concentrations reached (630.1 -711 -744) ppm respectively, while the second site was the highest site according to the international standard. The soil is considered high salinity.

Table 7. Saline elements of the soil of the study area

ITEM	S1	S2	S3	S4
PH	7.9	7.7	7.3	7.1
Ec Desmans /m	2.4	14.2	5.3	2.1
TDS	630	1451	711	744
PPM	121	282	206.4	201
PPM	109	120	106	87
PPM	187	253.5	181.2	135
PPM	190	215.4	255	235
So_4 ppm	250	130	143	167
PPM	190	231	174	121

Table 8. Global standard for soil pH (American Salinity Laboratory standard) (EA is and Environment)

Soil Reaction Limits	Soil Characteristic
Less than 4.5	Ultra-acid
5.00-4.5	Very pelvic
5 – 5.5	Severe pelvis
56	Medium acidity
6, 7	Mildly acidic
7	50-50.
7.8	Moderate Basal
8 – 8.5	Medium Basal
59	Very basic
More than 9	Very basic

Table 9. US National Advisory Committees Global Standard for Concentration of EC in Soils (U.S.D.A, 1960)

Electrical Conductivity (EC) Decimens/ m	Soil Class
4-0.	brackish
8-4	Medium salinity
8-15	High Salinity
15+	Very high salinity

Table 10. Global standard for saline elements in the soil (USDA) (ppm) (Pincon, 1991)

ITEM	brackish	Medium salinity	high salty
Potassium - K	Less than 200	2000	400+
Magnesium Mg	Less than 50	100% -50%	More than 100
Ca++	<$100	150 X 100	150+
Sodium Na	Less than 100	2000	OVER
Sulfate SO4	<$100	220	Greater than
T.D.S	Less Than 500	SUB-1000-500	Over 1000
HCO3	Less than 12.5	35 - 12.5	35+
Chlorine CL	Less than	121	Above 200
Calcium Carbonate	Just under 15.	35/15	35
Calcium sulphate	0.3	10 – 0.3	10+
phosphorous (P)	At least 10	10-15	More than 15

1. Sodium Na

It is clear from Table (7) that the concentrations of sodium vary spatially in the studied sites, as it was noted that the sites (s2 - s3 - s4) are of medium salinity according to the international standard (Almudhafar & Abboud, 2018), as their concentrations reached (282.5 – 206.4 – 201) ppm, respectively, while the first site was the lowest site according to the international standard, the soil is low in sodium.

2. Magnesium Mg

It is clear from Table (7) that the concentrations of magnesium vary spatially in the studied sites, as it was noted that (s1 - s3) are of medium salinity according to the international standard Table (10), where their concentrations reached (109 – 120- 106) ppm respectively, while the fourth site was the lowest site according to the international standard. The soil is considered low in magnesium.

3. Calcium Ca

The concentrations of calcium vary spatially in the studied sites (Table (7)), as it was noted that the sites (s1 – s3 - s4) are of medium salinity according to the international standard Table (10), where it reached.

Their concentrations (187.5 – 181.2 - 135.5) ppm respectively, while the second site was the lowest according to the international standard. The soil is low in calcium.

4. Chlorine (Cl)

It is clear from Table (7) that the concentrations of chlorine are spatially different in the studied locations, as it was noted that the sites (s2 - s3 - s4) are medium chlorine according to the international standard Table (10), where their concentrations reached (215.4 –255- 235) ppm respectively, while the first site was the least concentrated site (190) ppm, the soil is low in chlorine.

5. Sulfate SO4

It is clear from Table (7) that the concentrations of sulfates vary spatially in the studied sites, as it was noted that the sites (s2 – s3 - s4) are medium sulfates according to the international standard Table (10), where their concentrations reached (130 -143- 167) ppm respectively, while the first site was at the top of the site, with a concentration of (250) ppm, the soil is considered high sulfates.

6. Potassium - K

It is clear from Table (7) that the concentrations of potassium are spatially different in the studied sites, as it was noted that the sites (s1 – s3 - s4) are low in potassium according to the international standard Table (10), where their concentrations reached (190 -174 - 121) ppm respectively, while the second site was the average potassium and its concentration was (231) ppm, the soil is considered medium potassium.

Results

The study reached several agency results:

1. Natural environmental factors affect the soil (surface, climate characteristics, soil characteristics, water resources characteristics).
2. The climate characteristics such as heat, rain, relative humidity, wind, evaporation, and dust and dust storms affect the soil of the study area. Through very high temperatures and evaporation in

the summer, which exposes the soil to drought, which increases the concentrations of salt elements in soil.

3. the study that there are three four soils in the study area: river shoulder soils, which are characterized by relative height, alluvial tissue and medium permeability, which contributed to the low percentage of salts, and the soils of low basins with clay tissues, poor drainage and high groundwater, which led to a high percentage of salts in them. The soils of river islands, which were also characterized by their abundance and good characteristics, are few rivers, as the river is a natural trocar for them and gypsum desert soils, which are characterized by their coarse tissue and inability to retain water, so they are characterized by lack of salts in them.
4. The study showed that the characteristics of water resources in the study area have also contributed to influencing the characteristics of the soil of the study area by watering the land with these water with high concentrations of elements and saline chemical compounds.

The human environmental factors were (civil activities and their impact on the soil of the study area and agricultural activities and their impact on the characteristics of the soil).

In light of the discussion of the environmental assessment of the soil, it was noted that there is a spatial indication in the studied sites, as it was noted that there is a significant increase in the concentrations of saline chemical elements and compounds in the soils of cultivated and uncultivated river basins compared to the soils of cultivated and uncultivated rivers and desert soils. When comparing these concentrations with the international standard.

Conclusions

The study examines the impact of climatic characteristics, particularly high temperatures and evaporation, on increasing soil salinity in the Manathira District Center in Iraq. The soil consists of 4 main types: river shoulder soil, river basin soil, riverine island soil, and desert gypsum soil. These soil types have been negatively impacted by both natural and human factors. The natural factors affecting the soil include climate (high temperatures, evaporation), soil characteristics, and water resources. The factors include various human activities like waste dumping, improper housing, and poor agricultural practices. The study revealed that cultivated and uncultivated basin soils had elevated concentrations of dissolved salts—such as sodium, magnesium, calcium, potassium, sulfate, and chlorine—surpassing global standards. In contrast, the river shoulder soils remained within acceptable limits. The key hypotheses tested were that climatic characteristics play an important role in the high salt concentrations, and that salt concentrations vary spatially across different soil types based on the impacting factors. The study aimed to assess the impact of climate on increasing soil salinity and examine the spatial variations in salt concentrations, using field sampling and laboratory analysis of soil samples to measure parameters like pH, electrical conductivity, and concentrations of major cations and anions.

Author Contributions

All Authors contributed equally.

Conflict of Interest

The authors declared that no conflict of interest.

References

Abdil-Ameer, N. T., Almudhafar S. M., & Almayahi B. A. (2022). Environmental assessment of solid waste collection sites in Najaf Governorate. *International Journal of EcoMedical and Public Sciences, (IJEPS)*, 5(4), 01-05.

Abyss, K. D., Almudhafar, S. M., & Almayahi, B. A. (2022). The right of disabled children in Iraqi. *International Journal of Health Sciences*, 6(S4), 47269–47276. https://doi.org/10.53730/ijhs.v6Ns7.13129

Alattabi, I. A., Almudhafar, S. M., & Almayahi, B. A. (2023). Natural constituents of the elements affecting soil pollution and health effects and changing their properties by wastewater in Najaf district center. *Solid State Technology*, 63(6), 5438-5452.

Al-Jashaami, S. H. K., Almudhafar, S. M., & Almayahi, B. A. (2024). The Effect of Climate on the Variation of Pathogenic Bacteria in the Waters of the Manathira River. *Kurdish Studies*, 12(2), 2330-2341.

Al-Mudhafar, S. M. (2007). *Spatial Variation of Soil Pollution in Najaf Governorate* (Doctoral dissertation, MA Thesis, University of Kufa-College of Arts).

Almudhafar, S. M., & Abboud, H. A. (2018). Spatial variation of surface water contamination by heavy elements in Alhira relative to tourism. *African Journal of Hospitality, Tourism and Leisure*, 7(4), 1-7.

Almudhafar, S.M. (2018). Environmental assessment of shut alkufa in Iraq. *Plant Archives*, 18(2), 1545–1551.

Almudhafar, S.M. (2020). Spatial Variation of Biological Contamination of Soil from Najaf City. *Indian Journal of Environmental Protection this Link is Disabled*, 40(2), 192–196.

Almudhafar, S.M., & Alattabi, I.A. (2019). Effect of environmental factors on drainage water network in Najaf governorate, Iraq. *Indian Journal of Environmental Protection this link is disabled*, 39(11), 1050–1056.

Angin, P., Anisi, M.H., Göksel, F., Gürsoy, C., & Büyükgülcü, A. (2020). Agrilora: a digital twin framework for smart agriculture. *Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications*, 11(4), 77-96.

Directorate of Population Statistics in Najaf Governorate, Population Estimates in Najaf Governorate, unpublished data, 2021.

Donahae, M. (1980). *Introduction to soil and plant Grosth*. Prentice Hall, Engle Woodiffs, New Jereym.

EA, S. (1995). Environment London and Now York.

General Authority for Survey and Satellite Visualization of the study area using Arq Gis 10.5 software.

Hassan, A. H., Safaa, M. A., Iman, A. A., & Almayahi, B. A. (2023). Environmental Factors Affecting Surface Water in Al Mishkhab District. *Migration Letters*, 20(7), 261-276.

Hussein, S. A. (2017). *Geographical Analysis of Solid Waste Landfill Sites in Diwaniyah District and their Environmental Effects*. Master Thesis, Faculty of Arts, University of Kufa.

Kadhim, K. R., Almudhafar, S., & Almayahi, B. A. (2023). An environmental assessment of the non-living natural resources and the available capabilities and their investment in Al-Najaf Governorate. *HIV Nursing*, 23(3), 265-273.

Llopiz-Guerra, K., Daline, U.R., Ronald, M.H., Valia, L.V.M., Jadira, D.R.J.N., & Karla, R.S. (2024). Importance of Environmental Education in the Context of Natural Sustainability. *Natural and Engineering Sciences*, 9(1), 57-71.

Ministry of Agriculture, Directorate of Agriculture, Agricultural Division in Najaf, Planning and Follow-up Department, Statistics Division, unpublished data 2021.

Ministry of Water Resources, Directorate of Water Resources in Najaf Governorate, Water Resources Division in Al-Manathirah Unpublished data 2021.

Nabeesab Mamdapur, G. M., Hadimani, M. B., Sheik, A. K., & Senel, E. (2019). The Journal of Horticultural Science and Biotechnology (2008-2017): A Scientometric Study. *Indian Journal of Information Sources and Services*, 9(1), 76–84.

Noor, T. A., Safaa, M. A., & Almayahi, B. A. (2023). The Natural Characteristics Affecting the environmental pollution Contrast at the Center of Al-Manathira District. *International Journal of Academic Multidisciplinary Research*, 7(1), 166-175.

Pincon, (1991). Reclamation of poor soil with sunken and salted qualities, translated by Nadim Mikha et al., Dar Al-Hikma Press, University of Basra.

Radhika, A., & Masood, M. S. (2022). Crop Yield Prediction by Integrating Et-DP Dimensionality Reduction and ABP-XGBOOST Technique. *Journal of Internet Services and Information Security*, 12(4), 177-196.

Radmanović, S., Đorđević, A., & Nikolić, N. (2018). Humus Composition of Rendzina Soils in Different Environmental Conditions of Serbia. *Archives for Technical Sciences*, 2(19), 57–64.

Safaa, M. A., Almayahi, B.A., & Hanan, H. J. (2020). Effect of Environmental Parameters on Soil Salinity on Plant. *International Journal of Psychosocial Rehabilitation*, 24(5), 4247-4253. https://orcid.org/10.37200/IJPR/V24I5/PR2020140

Safaa, M. A., Azhar, R. S., & Basim, A. A. (2023). Spatial Analysis of Surface Water Contamination with Pathogenic Fungi Resulting from Sewage Sites in Najaf Al-Ashraf Governorate. *Journal of Chemical Health Risks*, 13(3), 996-1011.

Safaa, M. A., Maryam, A. R., & Basim, A. (2024). Spatial Analysis of Household Waste's Impact on Soil and Air Pollution. *Indian Journal of Environmental Protection*, 44(2), 52-685.

Safaa, M. A., Noor, T. A., & Basim, A. A. (2023). Environmental Assessment of Surface Water Contamination with Pathogenic Bacteria in the Manathira District Center. *Journal of Chemical Health Risks*, 13(3), 1067-1077.

Safaa, M. A., Noor, T. A., & Basim, A. A. (2023). The Impact of Pathogenic Fungi on Soil Contamination in the Center of the Al-Munadhirah District. *Journal of Chemical Health Risks*, 13(3), 1056-1066.

Safaa, M. A., Russel, A. M., & Basim, A. A. (2023). Environmental Assessment of the Impact of Water Pollution in the Bahar Al Najaf on Plants. *Journal of Chemical Health Risks*, 13(3), 1036-1046.

Samer, H. K. A., Safaa, M. A., & Basim A. A. (2024). A Spatial Analysis of the Influence of Environmental Factors on the Growth and Proliferation of Pathogenic Fungi in the Manathira River. *Kurdish Studies*, 12(2), 5450-5461.

U.S.D.A. (1960). Definition and abbreviation for OIA Description Berkey, California.

Wahhab, H. S. A., Almudhafar, S. M., Alalaq, A. S., & Almayahi, B. A. (2023). Social Environment and its Effects on Domestic Violence. *Revista de Gestao Social e Ambiental*, 17(7), e03536-e03536.