

Analysis of Soil and Water Characteristics in Shawan District

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Abstract

There are environmental problems that our world is exposed to today. We see that most of these problems are the result of factors, some of which may be natural, such as climate change, which in turn has had a clear impact on various countries, resulting in the retention of rain and an increase in temperatures, which leads to a cycle of drought waves, and some of them may be human factors. Resulting from the lack of proper treatment by humans with the natural resources in which they live, which led to their poor exploitation, whether through the wrong methods used in agriculture, poor irrigation, overgrazing, etc., all of which resulted in an imbalance in the natural balance, which was reflected in a bad impact on the environment, This is why desertification is considered one of the dangerous environmental problems that have plagued our world.

Keywords: *Soil, Water, environment.*

Introduction

There are environmental problems that our world is exposed to today. We see that most of these problems are the result of factors, some of which may be natural, such as climate change, which in turn has had a clear impact on various countries, resulting in the retention of rain and an increase in temperatures, which leads to a cycle of drought waves, and some of them may be human factors. Resulting from the lack of proper treatment by humans with the natural resources in which they live, which led to their poor exploitation, whether through the wrong methods used in agriculture, poor irrigation, overgrazing, etc., all of which resulted in an imbalance in the natural balance, which was reflected in a bad impact on the environment, This is why desertification is considered one of the dangerous environmental problems that have plagued our world. Although this phenomenon is not recent, its roots go back to the past, which was evident in the ancient Iraqi and Egyptian civilizations, as mentioned in a text found in the Lagash region near Shatrah today; In the Epic of Atarkhasis, he says something like, "The black fields became white and the vast plain was choked with salt," from which we infer how the lands in Mesopotamia, especially in its south, were fertile and black, and were covered by the salt that covered them and reduced their production.

Research importance:

The importance of the research lies in the fact that it deals with an environmental phenomenon whose importance stems from the importance of the subject itself, namely the phenomenon of desertification, which was reflected in the economic and social reality, which required us, as a researcher, to intervene to study the causes of the

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phenomenon, know it, identify it, and work to reduce and treat it, at a time when the demand for resources is increasing. Agriculture to increase population numbers and increase demand for these resources in the study area in particular and the country in general.

The study Problem: - (Problem of the study):

The problem of the study revolves around the extent of the impact of the phenomenon of desertification on the lands of the study area, its loss of large areas of agricultural land and the loss of soil fertility, and then removing it from productive lands to desertified lands located outside production and its impact on the social and economic reality.

- 1- What are the factors causing the phenomenon of desertification in the study area?
- 2- Is there variation in cases of desertification in the study area?
- 3- What is the nature of the risks resulting from the phenomenon of desertification in the study area?
- 4- What are the means and methods that we can follow to reduce and address the phenomenon of desertification?

Research hypothesis:

The research hypothesis is a preliminary explanation of the phenomenon, and it is a preliminary solution to the problem. The researcher can arrive at it through guesswork and logical intuition. By defining the problem, the study hypotheses can be formulated as follows:

- 1- Natural and human factors contribute to the emergence and development of desertification.
- 2- There is variation in cases of desertification in the study area

Research Methodology:

Within the study plan, in terms of style and methodology, the presentation of data was followed by relying on the scientific descriptive approach to geographical phenomena, due to the importance it reflects on the research work, and the adoption of the analytical approach, which is based on analyzing the elements of geographical phenomena and linking them spatially, and the analysis of soil and water samples, and the adoption of the quantitative approach, which is mainly based To use statistical models that provide us with accurate results for digital data, and to carry out field work to obtain the most accurate results.

Study structure:

The structure of the study is organized into three interconnected and consistent axes that complement each other, which include:

The first axis: analysis of soil properties

The second axis: analysis of water characteristics

The third axis includes means and treatments to confront desertification

The first axis:

Soil properties analysis: After going to the study area and learning about the types of soils, we learn in this topic about the most important components of the natural environment, which are represented by the soil. After starting analyzes of the soil properties, we

took 13) A sample from different locations of the soil of the study area, at a depth of (0-30) cm, as in Table (1-1) and Map (1-1).

Table (1-1) Analysis of soil properties in the study area

Counties	Sample	Gyps.	Organic	EC	Na	K	Ca	Mg	TDS	P.H
		%	%	ms	ppm	ppm	Ppm	Ppm	%	
Tolki	1.	2.07	1.66	1.3	75.95	209.20	81.36	86.97	337	7.9
Shocker	2.	2.00	2.98	0.7	75.95	192.24	48.06	141.29	366	8
Hamdoun	3.	3.72	3.52	0.85	105.35	183.66	86.26	110.62	146	8.1
Inside inside	4.	4.63	2.08	2.3	57.82	199.29	82.94	103.83	434	7.9
Ismail Bey	5.	5.47	3.44	1.05	88.2	306.27	78.35	107.43	143	8
kati rah sh	6.	3.96	1.67	1.3	67.62	190.47	76.69	100.72	327	8
There is an upper and lower ball	7.	3.76	2.14	0.75	75.95	181.31	55.66	57.22	121	8.1
Omar Mandan	8.	5.38	4.68	3.5	105.35	239.86	80.19	145.11	160	8
Qara Now	9.	4.97	1.66	1.1	139.65	233.04	72.59	129.29	254	7.9
Kahraza Khalkhalan	10.	3.32	1.82	0.9	76.44	184.84	64.13	91.61	142	8
Jan Qaz Alia	11.	3.48	3.64	0.8	88.2	174.61	59.37	115.91	162	8
Omar Bey	12.	9.39	1.09	4.6	155.82	242.89	81.69	121.93	635	7.8
Kokja	13.	11.67	0.98	6.9	139.65	307.48	89.42	86.97	1460	7.9

Source Based on the results of property analyzes of soil samples, College of Engineering Laboratories, Department of Chemical Engineering, Tikrit University, on 3/18/2023.

Electrical receipt (EC) Electrical Conductivity:-

It is one of the important chemical properties of soil, which contains easily soluble salts that have an impact on the productivity of the land. It is one of the problems of arid and semi-arid regions, which is affected by climatic conditions, water quality, topography, human activity, and drainage networks¹. This is because the concentration of salts changes some of the chemical and physical characteristics of the soil, which in turn affects the capacity and susceptibility of the soil in terms of air, water, porosity, and the extension of plant roots⁰.

Degree of soil interaction (PH):-

The degree of soil interaction means the effectiveness and activity of the hydrogen ion in the soil. Through this activity, we infer the level of basicity and acidity of the soil, which ranges between (1-14), and the average rate is (7), so if it rises above its values (PH (7) indicates the basicity of the soil, and if you say (7) indicates the acidity of the soil, the importance of the hydrogen ion concentration in the soil is highlighted because it determines the reactivity of the soil in terms of its fertility and its productive capacity. This depends on the dissolution of some minerals in it..

Organic matter (Organic Matter):-

Organic matter is represented by the products of the degradation of dead bodies, both animal and plant, as a result of life, physical, and chemical processes, the importance of which lies in the soil's fertility, through the nutrients it returns to it, improves its physical properties, and increases its ability to retain water seeping through it. The percentage of organic matter can affect the desertification process in general, but this depends on the conditions and environmental factors specific to each region.

Dissolved salts (TDS)

It is the sum of dissolved salts of positive and negative ions, in addition to the elements and secondary and rare materials. Its values increase in soils with a mixture and clay texture, as well as desert and dry irrigated lands, as a result of their weak permeability and high clay percentages⁰. The effect of dissolved salts on soil fertility and the process of desertification depends on the type of salts, their concentration in the soil, and the extent of their effect on plants.

gypsum (Gypsum):

Gypsum is found in the soil of dry and semi-arid regions in varying quantities. The source of gypsum in some types of soil is the sedimentary materials from which the soil is formed, or it may be calcium deposits. Ca^{+2} with gypsum sulphate leads to its structure being weak, with the surface layer of the soil being weakly able to retain water, which leads to an increase in the value of gypsum, which leads to the destruction of the structure of the soil and the formation of a solid crust, with the importance of its presence, when the water rises by capillary action after the water evaporates from it.⁰

Sodium (sodium) :-

The soil contains quantities of sodium (Na) in high percentages leads to the soil heading towards poor construction and ventilation, which harms plants through poor soil fertility. According to the American laboratory, soils are classified as sodic if the sodium percentage rises above (15)% and has a basic reactivity level between (8.5-10)¹. When the percentage of sodium exceeds the percentage of magnesium and calcium, it may lead to the appearance of alkaline problems in the soil, especially in dry and semi-arid areas, in addition to the poor composition of the soil, especially clay, because it disperses its particles, and we have a hard, superficial crust on top of the soil surfaces, which affects the plant..

(Calcium):-

The percentage of calcium in the soil is an important indicator for estimating soil fertility and determining the potential for plant growth in it. A high calcium value usually indicates calcium-rich soil, and this may be beneficial for plants that need large amounts of calcium. However, if calcium increases to excessive levels, it may negatively affect the availability of some other elements and the ability of plants to absorb them. Analysis of the data provided helps in understanding the concentration of calcium in the soil, evaluating its fertility and its effect on plant growth. It is also recommended to consult with experts in the field for more detailed guidance on the effect of calcium on soil fertility and how to improve soil quality if necessary.

Potassium:-

Potassium is present in the soil in large and abundant quantities, but what is observed in its presence in the soil solution is in small quantities, as a result of its mixing on surfaces in clay grains, as its importance lies in the process of photosynthesis and the development of the green substance chlorophyll in plants⁽²⁾. Its amounts and value in the soil decrease when there is continuous stress and pressure on the soil, which results in a decrease and

the soil is poor in this element, and here the deficiency in the soil must be compensated for by chemical fertilizers that are added to it (2).

Magnesium:-

Magnesium is another nutrient essential for the growth and development of plants. It plays a vital role in plant metabolism and proper coordination of physiological processes. The importance of magnesium comes (Mg) in the soil as it is an important element in the process of photosynthesis and plant pigment, which is a nutritional element for plants. Magnesium is a common element spread in the soil of arid and semi-arid areas that are affected by salts and irrigation water (2).

The second axis: -

Analysis of water characteristics in the study area

Water has a very important role, especially in the manifestations of desertification, when it is invested in the study area. The properties of water must be identified by conducting laboratory analyzes taken from the study area. Therefore, 10 samples of surface water and well water, as shown in map (2-1) and table (2-1), through which the following results were reached:

Table (2-1) Analysis of water samples in the study area

Hardship	Na	K	Mg	Ca	P.H	EC	TDC ppm	Water type	Coordinates		Samples
250	5.7	4.3	100	150	7.8	284	156	Surface water	44.20.35	E	Tolki
									35.47.00	N	
200	14	6.2	50	150	7.5	302	166	Surface water	44.25.30	E	Kokja
									35.36.20	N	
200	13	4.7	50	150	7.6	288	158	Surface water	44.27.10	E	Inside inside
									35.45.53	N	
200	13	5	50	150	7.9	306	163	Surface water	44.34.40	E	Omar Mandan
									35.40.00	N	
200	13	5	50	150	7.9	306	160	Surface water	44.34.50	E	There is an upper and lower ball
									35.43.10	N	
300	11	11.7	100	200	8	420	294	Wells	44.28.13	E	Omar Bey
									35.30.15	N	
300	11	1.5	100	200	7.9	422	295	Wells	44.47.10	E	Kahriz Khalkhalan
									35.44.30	N	
325	63	1	100	200	7.5	517	375	Wells	44.26.40	E	Jan Qaz Alia
									35.41.23	N	
300	11	1.5	100	200	7.9	422	295	Wells	44.34.45	E	Qara Now
									35.51.20	N	
325	63	1	100	200	7.5	517	360	Wells	44.33.30	E	As if I

									35.50.45	N	saw him
2600	217	41.9	800	1750	77.5	3784	2422				the total
260	22	4.19	80	175	7.75	378	242.2				the average

Source: Based on the results of chemical analysis of water samples, North Refinery Laboratories, Baiji Refinery, dated 3/16/2023.

TDS (dissolved solids)

This ratio indicates the concentration of total dissolved salts in water in parts per million (ppm). This indicator measures the total concentrations of all dissolved salts in water, including mineral elements and other chemical compounds.

Electrical conductivity (EC)

Value EC is a measurement of the electrical conductivity of water. It is measured in electrical conductivity unit's microsiemens/cm. The EC value depends on the concentration of dissolved salts in the water, as increasing the concentration of salts increases the EC value. According to the table, the results presented indicate the presence of a moderate concentration of dissolved salts in the water. The EC value can be used to evaluate the level of electrical conductivity of water and thus determine its ability to transmit electrical current. It is known that increasing the concentration of dissolved salts increases the EC value.

(PH)

pH represents the negative logarithm of the hydrogen ion concentration in water, as it represents a measure of the acidity and basicity of aqueous solutions, whose values range between (0 - 14), so if the value of (PH is less than 7, then the water is acidic. If the PH value is more than 7, the water is basic, while if the PH value is equal to 7, it is equal..

Calcium

The source of calcium results from the processes represented by weathering and evaporates that occur within the layers of rocks in the region, as the amount of calcium increases with increasing temperature and pressure.

Magnesium

Magnesium is one of the causes of hardness, as it represents an alkaline earth metal, formed from the natural dissolution of limestone rocks and the mineral dolomite, as well as other clay minerals, all of which represent a source of the element magnesium..

Potassium

Potassium is found in clay minerals and feldspar, as it is noted that its value is lower than the sodium ion due to its resistance to chemical weathering of water..

Sodium

Most of the sources of sodium ions in natural waters are clay minerals and halite that are present in the sediments of the Fatha and Quaternary era, as their source within the study area is the weathering of evaporite rocks that are within the layers of the region or the deep waters that emerge from the faults and breaks..

Hardship:

Hardness results from the presence of binary mineral ions, including calcium and magnesium, which are more abundant, especially in groundwater, to interact with stones and work to dissolve them, which is expressed incaco3Gypsum, anhydrite and dolomite rocks are main sources that provide water with calcium and magnesium ions, and these in

turn are a source of hardness in the water because they come into direct contact with these rocks..

The third axis: -

Means to address desertification in the study area

After we studied the monitoring of the risks of desertification in the Shawan district and explained its condition and its natural and human causes, it became clear to us that it is a state of continuous and gradual deterioration resulting from the combination of a number of natural factors on the one hand, and human misexploitation of these factors on the other hand, in addition to other factors such as residential use and encroachment. On agricultural lands and overgrazing. All of these factors and others contribute to the emergence of the problem of desertification and the increase in the area of desertified lands.

The most important treatment methods: -

1. Treatment of saline soils and cultivation:

Soil salinity is a form of soil degradation and a manifestation of desertification. It occurs as a result of poor management of irrigated soil, lack of water drainage, or lack of excess water, and poor management of the irrigation systems in place. Soil salinization must be monitored on an annual basis, by estimating the annual increase in salinity within Soil from a depth of (0-60) cm. This is why soil salinity has harmful and dangerous effects on the soil. This problem has had its effects on the study area, especially the soil of cultivated or arable lands, through the deterioration of crops, which results in a reduction in production quantities. If it continues, it will lead to the exit of large areas of arable land into... Non-agricultural lands, or leaving those lands, so it was necessary for us to take a set of measures and treatments in order to preserve the soil from salinization, after recognizing that the soil of the study area suffers from it in its agricultural lands, so its soil needs agricultural reclamation operations, as it is intended The process of agricultural reclamation includes all the necessary activities and operations to improve the productive capacity of non-productive or low-production soils. Therefore, the concept of reclamation may expand depending on the nature of the problem that the soil suffers from.. The most important methods of treating saline soil are: -

2. Establishing irrigation projects and drainage networks: -

Large areas of the region's lands suffer from high levels of salinity, and the main reason for the salinization of these areas is the use of groundwater, which is considered unsuitable for agricultural use in many cases, due to the nature of the region's soil and the components it contains. Therefore, the idea was to raise the waters of the Zab River to some areas. The district is an idea with a positive impact, while many lands suffer from the same problem and have the same qualifications, and many farmers in it still depend on groundwater. Therefore, the most important proposed solutions are to establish irrigation projects in a number of areas within the district, to revitalize large areas of land. And freeing farmers from dependence on groundwater.

3. Using modern irrigation methods:

One of the most important methods used to reduce the problem of soil salinization is the use of modern irrigation techniques because of their significant impact in reducing water waste during the process of irrigating agricultural crops. Irrigation methods in the district depend on three sources:

- 1- Depending on rain water
- 2- Depending on the water of the Zab River
- 3- Depending on well water.

4. Using the agricultural cycle system: -

What is meant by agricultural rotation is the system of alternating agricultural crops on the same land area of the agricultural field, permanently and continuously, within a planned agricultural cycle, taking into account the climatic conditions and soil condition, and it is cultivated continuously and alternately with agricultural crops, and the agricultural rotations commonly used in Iraq are two- and three-way. The quadripartite cycle is in irrigated lands, while in irrigated lands the single cycle is commonly used.

5. Soil washing and maintenance process:

The process of washing the soil represents ridding it of its salts after releasing the water into the field. Some time is left for it to dissolve the salts, and then the water and the salts dissolved in it are drawn out of the field, as they are drained into the sewers.. The process of washing the soil is done by plowing it and then softening it with the plow. After that, making the land with a slight slope suitable for the water to seep into the field and subsidiary drains and then into the main drains, dividing the land into panels and flooding it with water. It is preferable to carry out the process of washing the soil in the winter so that the necessary water is available. Low amounts of evaporation, which requires the availability of large amounts of fresh water.

6. Addressing the problem of overgrazing and pasture degradation:

In the study area, we found that the impact of overgrazing on pasture lands, agricultural lands, and natural plants, and that the carrying capacity of pastures exceeds their carrying capacity, in addition to the area of natural pastures that has begun to shrink, as previously mentioned, and this matter is one of the aspects of desertification, in addition to the destruction that affects the cover. Vegetation of natural pastures and the inability of the land to support the aforementioned numbers of livestock of various types, which leads to desertification.

7. Addressing the phenomenon of urban expansion:

It explains to us that urban sprawl and its expansion are among the most influential manifestations of desertification on agricultural lands, and that it is considered very severe desertification, and it cannot be repaired or the land returned to its natural state.. It is one of the phenomena that is constantly increasing with the increase in population, as most people in the study area confirmed the seriousness of the problem of urban sprawl, except for many who do not acknowledge this problem because many of them are the cause of it. Although Iraqi law does not permit the conversion of agricultural land to urban use, this phenomenon has begun to worsen due to the absence of government control in most of the lands of the study area.

Conclusions:

1- Surface characteristics played the largest role in the spread of the phenomenon of desertification, through its most important manifestation, which is soil erosion in areas with severe erosion, especially in the northern regions of the study area.

2- The soil of the study area suffers from weak organic matter, which affects the complete growth of plants, whether seasonal or perennial, due to the weak ability of the soil to germinate. This is mainly due to the fact that the soil of the study area is shallow, being turbid areas.

3- Human factors have a negative role in the emergence and aggravation of the problem of desertification in the study area through the poor use of natural resources represented by wrong methods of agriculture, poor irrigation, cutting down trees and shrubs, and urban sprawl at the expense of agricultural lands, in addition to overgrazing, the lack of windbreaks, and the movement of machinery on unpaved lands.

Recommendations:

The study recommends the following:

- 1- Work to achieve the green belt plan around cities, because the many dust storms we are seeing today have major impacts on the environment. Therefore, the green belt around cities with tall trees works to reduce this phenomenon.
- 2- Developing natural pastures is one of the important means of reducing desertification in its many manifestations, the most important of which is the phenomenon of erosion, both hydrological and wind.
- 3- Paying attention to the actual application of means to reduce the manifestations of desertification by treating those widespread manifestations in the study area and following up on this by the competent official institutions, knowing that the study area is devoid of any special official interest and care in this aspect, so their efforts must be coordinated in order to address the manifestations of desertification. .
- 4- Emphasis should be placed on following the agricultural rotation system and avoiding fallowing, because most farmers did not follow this system in agriculture, which led to the loss of soil properties, and then agricultural land production decreased significantly. Therefore, we recommend the importance of following agricultural rotations in order for the soil to regain its fertility and reduce the manifestations of desertification.

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