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Desertification And Its Impact On Agricultural Production In Iraq

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

[1]Faculty of Physical Planning, Urban Planning Department, University of Kufa, Najaf, Iraq; samer.khidhr@uokufa.edu.iq; https://orcid.org/0009-0002-2090-7614
[2]Department of Geography, Faculty of Arts, University of Kufa, Najaf, Iraq; safaa.almudhafar@uokufa.edu.iq; https://orcid.org/0000-0002-0425-2868
[3]Department of Physics, Faculty of Science, University of Kufa, Najaf, Iraq; basim.almayahi@uokufa.edu.iq; https://orcid.org/0000-0001-7052-8060

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Abstract
Desertification is one of the most critical environmental challenges facing Iraq, significantly impacting agricultural productivity. This paper explores the phenomenon of desertification in Iraq, its causes, and its detrimental effects on agricultural land. The study highlights that about 90% of Iraq's land falls within arid andsemi-arid climates, exacerbating desertification. High temperatures, reduced rainfall, and improper land management are major factors contributing to soil degradation. The research focuses on the causes of desertification, such as human activities, climate change, and poor agricultural practices, and assesses the resulting decline in Iraq's food production capacity. The paper also discusses strategies for combating desertification, including land management, technological interventions, and policy recommendations to protect Iraq's remaining arable land.

Keywords: Desertification, agricultural productivity, soil degradation, climate change, arid regions, land management, environmental sustainability.

Introduction

The problem of desertification is one of the most serious humanitarian problems and has become one of the most serious challenges facing humanity in this century. Deserts are one of the environmental systems formed by geological and climatic factors and characterized by harsh and extreme conditions. Desertification is one of the manifestations of environmental degradation [1-3]. Land degradation in arid, semi-arid and dry sub-humid areas is the result of various factors, the most important of which are climatic differences and human activities. It indicates the quantitative and qualitative decline in the productive capacities of the land, the destruction of the potential biological energy and the degradation of ecosystems. There are factors causing desertification and diagnosing in two groups. The first is natural factors such as soil and climate, and the second is related to humans and management [4,5].

The concept of desertification is generally viewed from different angles. It can be defined as "the prevalence of desert conditions", as well as "the encroachment of the desert", "high rates of drought", or "poor ability of the land to produce". Despite the multiplicity of its concepts, the characteristic of participation in the multiplicity of concepts converges on one indisputable point, which is the characteristic of drought and desertity that the concept carries among its folds [6-8].

The natural conditions in Iraq have helped the occurrence of desertification [9-12]. About 90% of the area of Iraq lies within the arid and semi-arid climate zone. Summer temperatures rise to (52) degrees with the high evaporation rate, especially in the sedimentary plain to reach 2000-3000 millimeters, as well as the high number of sunny days and reach an annual average of 260 days annually. Lack of rainfall, as in most areas of Iraq the rainfall is less than 150 mm and the rainfall rate in the south does not exceed (40) days and in the north more than (70) days. The lack of moisture, which is very important in the biological cycle of the soil and the growth of grasses, and the prevailing winds in Iraq are dry and hot northwest winds and spread local dust accompanied by hot, dry and long summers that have a role in the occurrence of desertification in Iraq [13-16].

Population growth leads to increased pressure on land to provide food needs and the deterioration of agricultural land turns this country into an importer of foodstuffs, which exhausts its budget and affects development and political stability [17-

19]. Some reports indicate that the agricultural sector contributes (18%) of the gross national product and represents (24%) of the labor force and the rate of arable land (3.0) hectares [20-22]. Today, there is a significant deterioration in land, especially arable land, which is the food basket for Iraq, where (80%) of it suffers from salinization. The food program in Iraq is falling by half every ten years, and now Iraq imports about (70%) of its food needs, and the main reason is the deterioration of the productive capacity of the land

The research was divided into the following sections:

1- The concept of desertification and its causes
2- Cases of desertification in Iraq
3- Impact of desertification on agricultural production in Iraq
4- Proposals to address desertification and develop agricultural production in Iraq

The concept of desertification and its causes

The concept of desertification is generally viewed from different angles. It can be defined as "the prevalence of desert conditions", as well as "the encroachment of the desert", "high rates of drought", or "the poor ability of the land to produce" and other meanings that have seriously discussed the subject [23-26]. Despite the multiplicity of its concepts, the characteristic of participation in the multiplicity of concepts converges on one indisputable point, which is the characteristic of drought and desertity that the concept carries. The geographical environment is not without the concept of drought and desert conditions. Rather, the concept of environmental balance does not occur without this natural difference in the elements of the environment. Land, water, the gaseous atmosphere, the lithosphere, forests and deserts are all elements and variables of natural life, which life cannot be imagined by losing one of them. The desert, then, is an essential part of the components of the natural environment (ecosystem) [27].
Where is the danger of the desert? Why should we be afraid of it? Weren't you part of our natural environment? When does the danger of the desert begin?Questions and axes that should be answered objectively without media exaggeration and hyper-speech, in order to take note of the subject and get to know it closely, and to reveal its environmental risks, which helps in the success of the solutions and proposals developed for treatment.

The concept of desertification began to worry the international community and attract the attention of researchers remarkably after the fifties of the last century. It is worth mentioning that this early interest in studying the phenomenon and identifying it was not a coincidence. Rather, it contributed to the crystallization of this concept and the growing interest in it, the nature of its effects, such as drought and increasing its rates, sand dunes and their seasonal movements, and the poor ability of agricultural soils to produce well. All these effects and factors made this concept rise to the surface and become a fertile scientific material for many studies at various disciplines and levels. The world has well realized that the growing environmental effects of desertification and leaving them without causing any natural or human changes will eventually lead to the occurrence of environmental disasters with undesirable consequences, and human achievements will incur many losses, and waste many of their energies. It will ultimately portend a threat to human existence at all. Desertification intensified when its rates in Africa reached more than 32%, so that this large percentage of the continent's land suffers from drought, 21% in Asia, and 12.5% in the New World. These proportions mean the loss of millions of hectares of agricultural land after being completely washed away by desertification and turned into dry desert lands and environments. After the problem turned into a worsening danger in the 1980s, it began to be strongly included in the priorities of contemporary problems facing man and his environment, such as environmental pollution, the problem of ozone, the thermal balance, sudden climate changes and others. Therefore, the concept of desertification entered international and political forums, specifically after the Nairobi Conference of 1977, and interest in it increased by international organizations and public bodies such as the United Nations and its development programs, which drew an international concept of desertification that is almost more important than the definitions that preceded it. It states that desertification is: “Land degradation in arid, semi-arid, dry, semi-arid and semi-humid areas, which leads to the destruction of the vital and productive energy of the land and ultimately leads to the prevalence of desert conditions, leading to poverty excluded from vegetation and increasing drought rates” (1).
From the international definition of desertification, several indicators are understood, the most important of which are:
1. The process of environmental degradation.
2. The prevalence of the concept of global drought.
3. Lack of land productivity and loss of vitality.

4. Vegetation removal in all its forms.

Here, it can be said that the concept of contemporary desertification has become more accurate than its classical concept, as it includes the concepts of excessive consumption, food production problems, high rates of environmental, health and even psychological pollution for humans, as well as soil salinization, flooding and widespread degradation in global ecosystems, which led to the lack of vitality of the land with its plant and animal production, which had a direct impact on the concept of food security, and high rates of population migration from areas with high desertification to areas with abundant production, which may also expose them to rapid deterioration.

Causes of desertification and its increase

Desertification is a geographical phenomenon dating back hundreds of years, and this phenomenon has had a direct impact on the removal and collapse of many human civilizations throughout history. Perhaps the simplicity of the image of life and the limitations of its technologies and requirements in the past made desertification limited to one image and a certain appearance, which is the problem of salinization of the soil. Nowadays, contemporary life systems have developed and their technological and technical requirements have increased, which has been reflected in the excessive pressure on natural resources, which has led to the acceleration of the process of desertification of the land and the loss of its vitality.In fact, desertification means the process of demolishing and destroying the vital energy of the earth, in which many natural and human factors are involved, foremost of which is man and his multiple activities. Here, it is necessary to distinguish between these causes, regardless of their degree of impact:

Human Factors

Many scholars are convinced that human factors are the primary cause of this phenomenon and its high rates. These factors take many forms, including:

i. (f) The high population growth rate.

It began to become clear that the increase in the number of people and their growth in the world is a major problem of contemporary problems. Humankind needed to reach the first billion tens of thousands of years, but, after that, it only needed less than a thousand years until it reached its sixth billion.. The nature of population inflation, which has become a reality imposed on the land, needs the natural resources it provides to secure the lives of the population. As a result, the land remains the only main source of food production globally. The process of directing the population towards the full use of the land's natural resources has shown its ability to produce deterioration, specifically in the process of producing strategic grains (the main source of food in the world), which led to the human resort to the frequent use of chemical fertilizers, which have become the main source of soil pollution and exposure to desertification.

Wide Urban Growth

The high rates of global urban growth of the population have led to encroachment on large areas of productive agricultural land and the removal of vegetation cover, which is a natural result of the phenomenon of urbanization. Urban population rates in the world have increased from 53% in the middle of the last century to about 80% at the end of the twentieth century. This increase needs many food and spatial requirements. Urban sprawl is invading rural areas strongly, specifically in major cities, which has reduced the size of agricultural land, which has sometimes exposed it to desertification, and to urban exploitation and changing its identity at other times.

Vegetation removal

This type of encroachment on agricultural land and forest systems occurs as a result of the increasing human need for both wood and land to establish its various facilities, and thus a severe shortage of green land areas and sovereignty in the concept of desertification.

Overgrazing and overgrazing

This type of encroachment on agricultural land and plant territories occurs at very high rates of overgrazing and continuously, which exposes the soil to the loss of much of its vegetation cover and thus exposes the soil to further erosion and water and wind erosion.

Increasing environmental pollution rates:

Human misuse of terrestrial, aquatic, air and pastoral natural resources also results in environmental pollution that deteriorates the natural environment and exposes it to continuous dangers, including desertification. Terrestrial pollution increases human consumption of fertilizers by 20% or more annually, most of which is deposited in the soil layers, which exposes its biological balance to imbalance, as well as water pollution with toxic industrial waste, and air with harmful gases and fumes in the nature of the ecosystem, so humans, animals and plants are exposed to their deadly risks.

Traditional Agricultural Methods:

The world loses thousands of hectares annually as a result of human use of primitive agricultural methods such as marginal agriculture, old cultivation methods and underdeveloped irrigation methods. Farmers' ignorance of modern advanced agricultural methods is often reflected in the productive capacity of the land and its ability to give. Thus, many arable lands have gradually turned into desertified lands as a result of many human conditions practiced on them, such as the use of water that is not suitable for irrigation, or the inappropriate times of used irrigation, which exposes the soil to salinization and senescence, which is the most severe case of desertification.

Natural factors:

They can be summed up by sudden climate changes, global warming and an increase in the percentage of carbon dioxide in the gaseous atmosphere, which in themselves have become fundamental problems facing the world today, as well as the effects of extreme climates experienced by many climatic circles in the world, which lead to high rates of soil erosion and deterioration of fertility. Sudden climatic and natural conditions such as earthquakes, floods, torrential torrents, rising sea waves and hurricanes, which contribute significantly to the removal of vegetation cover, in addition to the lack of water sources, which leads to drought and death in many agricultural crops.

Cases of desertification in Iraq:

Iraq has known desertification in the past since the emergence of its first human civilizations on the land of Mesopotamia, and the rates of desertification have continued to the modern date. Iraq has suffered greatly from the problem of soil salinity, which has continued until the present time, as well as the manifestations of urban and desert encroachment, which has reduced the opportunities of the green area. Recent studies indicate that the percentage of Iraqi land exposed to desertification reached 4.012.900 hectares (3). Therefore, forms of desertification in ethnicity can be classified as follows:

Salting and flushing the soil

Most agricultural and arable land in Iraq faces many problems of desertification. Through the distributional map of desertification, we can understand the forms and manifestations of desertification. It is found in the north, center and south of the country. However, the problem of soil salinization remains one of the most prominent problems that the Iraqi soil suffers from at all, and it directly suffers from the Iraq Sedimentary Plain, which extends from southern Samarra to southern Basra. Most of its manifestations are the high rates of groundwater, which is primarily responsible for the salinization of the soil, its abundance, and the weakening of its production capacity. The percentage of salts in the soil of the sedimentary plain is estimated at 225 kg per acre (4).

Soil erosion:

This type of desertification is concentrated in the northern and northeastern parts of the homeland, and the topography of the surface, represented by the severe slope of the surface in most of its manifestations and the high inclination of the surfaces on the one hand and the high rates of rainfall of the region annually on the other hand, played a major role in the exposure of the soil to erosion from the heights towards the lower areas. The accumulation of snow over mountain peaks and highlands and their melting in the spring season exposes the soil to cases of severe erosion, and it is estimated that the rate of desertification of this type is 13%.

Desert encroachment

Most of the lands of the Middle Euphrates governorates as well as the Upper Euphrates suffer from the increase in desert activity represented by quicksand, as the area of sand dunes in Iraq is estimated at more than 6 million dunums distributed on various parts of the country and extending from the south of Basra governorate to Najaf governorate with an estimated area of 1,684,000 dunums.

The other geographical area extends from the northwest of Karbala Governorate to Anbar Governorate, which was estimated at 38,000 dunums. As for the third range of desert encroachment, it extends from the Nukhayb area to the city of Anah with an area of 36,900 dunums (5).

Causes of Desertification:

Since desertification is a complex and interrelated environmental, economic and social problem, a number of natural and human factors intertwine to create it. As for the first factors, we find the recurrence of droughts in Iraq in recent decades. For example, rainfall decreased by 30% from the average, and the water level in the main rivers fell by more than50% in 1999. As a result, rain-fed crop production declined by 70% and wheat and barley production losses by 37% and 63% in the central and southern regions, respectively. The problem is further complicated if we know that the desert climate prevails in 70% of the lands, especially in the sedimentary plain and the western plateau, where annual

rainfall ranges between 50-200 mm.

Salinization is the main factor of desertification, which has reached a very dangerous degree. In fact, the spread of salts in the Mesopotamian plain, after cultivation during successive generations, where historical sources indicate that the history of irrigating agricultural land in this plain, dates back more than six thousand years. Hence the view that the movement of the centers of ancient civilizations from the south to the center and north was caused by the spread of salts in the soil and the decline in its production. It is clear that the spread of salts is due to geomorphological, hydrological and climatic factors, water and soil properties, and to the human factor of not using appropriate irrigation methods. This means the absence of water technologies and scientific methods used in agriculture, despite many years of talk about interest in agriculture.

Overall, the problem of salinity is caused by many factors, some of which relate to the natural environment, and the other to human work. These factors overlap in the degree of their impact on the spread of salinity, whose levels vary from place to place and increase as we go from north to south and from high to low sides. Natural factors have a prominent role, as the climate comes first, as the increase in the amount of solar radiation, high temperature, lack of clouds, relative humidity, and the predominance of north and northwest winds increase the intensity of evaporation, and thus increase the percentage of salts. This coincides with excessive irrigation operations, especially since the water used in turn contains different proportions of salts, the amount of which varies from place to place and from season to season. The nature of the soil also has a clear impact on the emergence of the problem and its exacerbation with the accompanying adoption of wrong agricultural systems.

Iraq's soil contains high saline components, as it is estimated that 61% of agricultural land is threatened with salinization, with an average of 8%. This means that all soil will be salinized after 12 years, if an appropriate drainage system is not used. When the water level rises in the flood or irrigation season, the salts rise to the top of the soil, so puncture becomes very important. Since the land is very flat; Baghdad, for example, despite its distance of 550 km from the Arabian Gulf, it is only 34 m above sea level, and this contributes to the difficulty of drainage. Salinization of agricultural land has become a serious problem as a result of irrational water use, in addition to poor irrigation and irrigation canals. This led to the rise of groundwater and the accumulation of salts in the soil. Therefore, the plains, famous for their fertility, were turned into salted lands. Productivity in large swathes of land has fallen to almost zero. It is estimated that about 100,000 dunums (250,000 square meters) suffer from salinization annually, while the percentage of desertification in irrigated land in Iraq is 71%, while in Turkey, Lebanon and Syria it is 13%, 7% and 17%, respectively.

There are large quantities of saline water resulting from soil washing and wasted water in the fields amounting to 23 billion cubic meters/year, constituting 54% of the annual irrigation water and 38% of the water available to the country of 61 billion cubic meters/ year. Most of them are disbursed to rivers, marshes and depressions, as a result of the efficiency of the drainage network (field, pooled and subsidiary) and the neglect of the implementation of the main network, which led to the pollution of rivers and marshes with salinity, low efficiency and low soil fertility, especially in the center and south of the country, as the salinity of the Tigris River in Mosul, Baghdad, architecture, Qurna and in the Shatt al-Arab at the stronghold increased by 9%, 24%, 207%, 184% and 183% respectively during 1967-1991 and between 13-26% during 1993-2002. Other factors include the construction of dams and reservoirs on the Tigris and Euphrates rivers in Iraq, Turkey and Syria that affect the quantity and quality of salts . The salty waters of the Arabian Gulf in the Shatt al-Arab are provided as a result of the lack of its water and the drainage of the water of factories and military manufacturing projects to the rivers without being chemically treated because of the weakness of control and neglect, if any, and the lack of treatment of city sewers that are discharged to the rivers.

If we examine salinization in the governorates, we find in Babylon 743776 dunums that were salinized due to groundwater and mismanagement. In Salah al-Din, salinization is widespread in all agricultural areas, in Qadisiyah, there is moderate salinization in the Sumer-Shanafiyah-Badir region due to the inefficiency of the puncture system, in Diyala, there are dispersed areas, in Anbar in Saqlawiya – Grey 12500 dunums, in Al-Khor-Rawa 625 dunums, in Dhi Qar all irrigated lands from the Tigris, Euphrates and Al-Tar area are very saline, in Basra, salinization is widespread due to the salinity of water, especially in Medina, Qurna, Shatt al-Arab and Al-Faw, in Wasit 75% of the area of the governorate is infected with salinization due to the high groundwater and its containment of sodium chloride, in Ninewa in Sheikhan and the administrations, in Karbala in the whole governorate, especially in Furaha, Al-Khirat and Al-Ibrahimiya road. Salinized lands are estimated at 25% of the governorate area, in Muthana 1360325 without salinization, and constitute 6.5% of the area of the governorate, and in Baghdad, and in 29500 without salinization in different areas, and from this widespread and serious problem of salinization in agricultural lands.

Another factor of desertification is the decline of forests, which cover 1.8% of the total area. According to FAO, it occupies 789,000 hectares and forest cultivation 10,000 hectares. It covers the mountainous areas in the north and northeast (Kurdistan). It covered 1,851 million hectares in 1970 but declined to 1.5 million hectares in 1978. The first percentage decreased to 1.1%. The area removed annually is 12 km² and the annual rate of removal was 0.2% in the period 1990-2005. We now see solitary forests of oak trees in the most remote lands. Forest degradation has resulted from extensive felling, pastoral pressure, burning, and military operations. This leads to increased water erosion and causes the disappearance of the fertile layer of soil, negatively affecting the dam storage capacity and irrigation efficiency and increases costs. The number of palms has also declined from about 30 million to about 9.5 million due to wars, especially the Iraqi-Iranian war, lack of water and salinity, agricultural diseases and neglect. Therefore, the degradation of forests and other plants has become an important factor in the deterioration of the environment and its tendency towards drought.

The degradation of rangelands, which constitute 70-75% of the country's area, contributes to desertification and results from: pastoral pressure, cutting and uprooting of fodder plants for fuel purposes, cultivation of rangeland lands with rainfall less than 200 mm per year, failure to regulate water distribution, which leads to the concentration of livestock in lands that have water, with negative effects on vegetation cover. Rangelands have therefore deteriorated in recent years leading to a deterioration in their pastoral value.

The impact of desertification on agricultural production in Iraq

How it affects agricultural production. For the first, human use of natural resources is a consumption of them, and therefore the quality and intensity of use either leads to the deterioration of the environment or keeps it in balance. This is represented by the degradation of plant and animal life, the degradation of soil and rangelands, the shrinking of agricultural or reclaimed land, the shortage of water and the deterioration of its quality, especially its high salinity. It is all due to the improper and unjust use of these resources. Land that is desertified or in the process of desertification results in a decrease in the productivity of ecosystems or agricultural systems, whether natural pastures, forests or cultivated land. Ultimately, environmental degradation can be a major factor in climate change.

Sand dunes are one of the most dangerous consequences of desertification because of their negative effects on all vital aspects of life. Dust and sand storms are a harmful feature, and their main manifestation is the spread of sand dunes, often in the central and southern regions, and their movement by wind. These storms pollute the environment and affect human health and agricultural production. It sabotages the physiological processes of plants, especially pollination and flowering. Sandstorms blow from sand fields in the central and southern regions. They have increased in recent years and the problems have become worse since the imposition of economic sanctions in 1990. Poor soil and water management and harsh climatic factors have extensively changed the agricultural lands of the sedimentary plain into arid and waterlogged soils covered with sand resulting from aerobic erosion and sand dunes. The maximum amount of dust falling in 2006 ranged from 9 in Anbar to 168 (g/m²/month) in Basra and the minimum ranged from 1.2 in Salah al-Din to 60 (g/m²/month) in Maysan.

It can be said that most of the dust storms originate from the land of Iraq, which is represented in the lands of the western plateaus, the island, and the lands left in the sedimentary plain, meaning that 80% of the area of Iraq south of the latitude 35 degrees north constitutes a source of dust of dust storms, while some of the dust originates from the desert of the Levant, the Arabian Peninsula, and the Sinai Peninsula.

As for the distribution of sand dunes at the governorate level, there are dunes in Babylon adjacent to the general estuary. In Saladin, north and south of Baiji , Tikrit-Kirkuk. In Qadisiyah, there are small dunes that move according to wind speed, in the Badir-Nefar-Afak area, in Diyala, relatively high dunes, and in Muqdadiyah, they are in a longitudinal, crescent, or fanned form. In Anbar, the soil is washed away by the wind due to lack of vegetation and drought. Sand dunes throughout the Western Desert move and affect the highway to Jordan and Syria. In Dhi Qar, there are moving sands in the area between the general estuary and the borders of Diwaniyah and Al-Badir sub-district. In Basra, the southern desert is sandy land where wells are drilled. In Wasit, there are sands in Nu 'maniyah with an area of 91 km² and Mufiqiyah-Sheikh with an area of 13 km². In Nineveh, the company is 4 km, Al-Burait 3 km and Nasiriyah, where the dunes crawl to these areas and reach the street leading to Al-Hader district and the airport with a length of 45 km. In Karbala, the dunes are located within a latitude of 32 degrees from the northwest and southwest. In Muthanna, the area of dunes is 65,000 dunums in the Warka sub-district, 25,000 dunums in the Najmi sub-district and 12,000 dunums in the Busayyah sub-district. There are fixed dunes with an area of 1,000 dunums in the Al-Hilal sub-district.

As for the economic results, they are represented by what was identified by the United Nations in its survey of the state of the world environment for the period 1972-1992, where it was stated: Land degradation and desertification affect the ability of countries to produce food, and thus involve a reduction in the regional and global potential for food production, and they also cause food deficits in threatened areas, with implications for food reserves and food trade in the world. Because desertification involves the destruction of plant life and the decrease of many plant and animal groups, it is one of the main reasons for the loss of biodiversity in arid and semi-arid regions, which reduces opportunities for food production. These conclusions apply to Iraq.

Agricultural land lost annually, as a result of salinization, erosion and soil degradation, is significant when compared to the total area of cultivated land. The area of agricultural land in Iraq is 42 million dunums, but it is available for agriculture to the extent of 14 million, including 6 million in the Dima region, whose production fluctuates according to the amount of rain. Therefore, agricultural production contributes to achieving food security by no more than 30% as a rate of various agricultural commodities, and this is one of the largest indicators of the food security deficit, and thus Iraq's increasing dependence on imports and its negative effects on the economic structure.

As a result of the exacerbation of desertification in the eastern part of Basra due to the deterioration of the quality of irrigation water and soil, and to the difficult conditions to which it was exposed during the military operations in 1980-1988 and in 1991 and 2003, this was a major reason for the expansion of vegetable cultivation in the Zubair region based on groundwater. Therefore, the region accounted for more than nine tenths of the cultivated area and production of most vegetable crops, especially tomatoes in the governorate, despite the harsh desert conditions and the decline in government support after 2003.

In general, desertification is one of the main factors that hinder social and economic development, and in turn increases economic problems, which in turn exacerbates environmental degradation, and thus we face a vicious cycle. The state of the environment cannot be separated from the state of the economy. Economic underdevelopment and environmental degradation reinforce each other to perpetuate underdevelopment.

As for the social consequences, the acceleration of desertification of the land and the decline in its productivity must have severe social effects, and this is clearly reflected in the increasing migration of rural residents and pastoralists towards cities in search of work and a better life. Migration intensifies in years of drought, and migration results in increasing pressures on the limited potential of cities, and also contributes to increasing the rate of growth of their populations faster than the countryside. These high growth rates place a burden on costly social services and at the expense of productive downstream structures. The pressure of migration generates a lot of social problems in cities such as: low standard of living, unemployment, lack of health and educational services, lack of housing, social tensions and conflicts, insecurity.... It is known that many migrants live in slums and shanty towns on the outskirts of large cities, “creating miserable communities prone to diseases and natural disasters.” The depopulation of the countryside contributes to the exacerbation of desertification. In Iraq, the deterioration of agriculture was accompanied by the acceleration of rural-urban migration, which resulted in a steady depletion of the agricultural workforce. During (1970-1975), this declined by 10% .

Proposals to address desertification and develop agricultural production in Iraq

Organizing the grazing process on all pasture lands: by controlling the movement of animals within the pasture temporally and spatially

Trying to stop and fix the sand dunes in several ways, including :

Mechanical methods:

Through the establishment of vertical barriers on the direction of the wind, including these roads:

Plant barriers: There are many plants that have the ability to stabilize sand .

Afforestation is the best in the process of fixation , but it is necessary to choose the appropriate plant species in terms of length, branching, root strength, resistance to damage and harsh environment.

Solid barriers: These are using curtain barriers from walls or trunks

Trees that are strong and intertwined with each other. Such as oil derivatives in the form of a spray that adheres to the surface soil. But this method has risks such as contamination of soil and water and impact on plants.

Conservation and protection of water resources:

This is done by making good use of these resources, rationalizing their use, and using modern methods of irrigation.

Human capacity development using modern technology and training specialists on it , especially with regard to combating desertification such as the

Remote sensing and aerial photography and determining the presence of groundwater in the ground. Spreading environmental awareness among citizens, especially farmers, livestock owners and herders

- Work to establish fixed and mobile stations to measure the level of pollution from gases and particles emitted by various means of transport periodically.
- Determine locally permissible "vehicle-generated" emission concentrations.
- Enact and enforce environmental laws and legislation on air pollution in the public and private sectors.
- Reducing taxes on the purchase of modern vehicles that are highly efficient.
- Establishing strict instructions on old vehicles in terms of importing them, renewing their licenses and maintaining them.
- Activating the annual vehicle inspection system and introducing the inspection of the percentage of exhaust gases emitted by the vehicle.
- Determine the criteria for the different types of fuels used in vehicles.
- Working to reduce the prices of high-quality fuel to encourage its use.
- Encouraging the replacement of the usual sources of fuel with clean ones such as natural gas.
- Paving and paving unpaved roads and working to establish a road network that includes all residential and industrial communities.
- Establish a regular and efficient public transport network.
- Reforestation of areas, especially on both sides of roads.

Supporting and encouraging programs that would raise awareness among citizens about the risks of increasing emissions resulting from transportation locally and globally and informing them of the benefits that accrue to them from reducing them.

Conclusions

Desertification has emerged as a serious threat to Iraq's agricultural sector, reducing the productivity of its lands and leading to increased dependence on food imports. The study confirms that climate factors such as high temperatures, low rainfall, and extreme evaporation rates, coupled with human activities such as improper irrigation and urban expansion, have accelerated soil degradation. The findings reveal that 80% of Iraq's fertile lands suffer from salinization, severely limiting agricultural output. Addressing desertification requires a comprehensive approach, including improved land management techniques, sustainable agricultural practices, and effective water use policies. By implementing reforestation efforts, controlled grazing, and technological advancements such as remote sensing, Iraq can mitigate the adverse effects of desertification and improve food security. Collaborative policy efforts at the national and international levels are also crucial to reversing this trend and protecting Iraq's environmental resources for future generations.

References

1- Safa Majeed Al-Mudhaffar. Spatial variation of soil pollution in Najaf Governorate. Master Thesis, University of Kufa - Faculty of Arts, 2007.P38
2- Ministry of Water Resources, Directorate of Water Resources in Najaf Governorate, Water Resources Division in Al-Manathirah Unpublished data 2021.
3- Ministry of Agriculture, Directorate of Agriculture, Agricultural Division in Najaf, Planning and Follow-up Department, Statistics Division, unpublished data 2021.
4- General Authority for Survey and Satellite Visualization of the study area using Arq Gis 10.5 software.
5- Hussein Saheb Al-Abadi, Geographical Analysis of Solid Waste Landfill Sites in Diwaniyah District and their Environmental Effects, Master Thesis, Faculty of Arts, University of Kufa, 2017, p. 55.
6- DonahaeM-Introduction to soil and plant Grosth, prentice Hall, Englewoodiffs, Newjereym,1980, p187.
7- Directorate of Population Statistics in Najaf Governorate, Population Estimates in Najaf Governorate, unpublished data, 2021.

8- Almudhafar, S.M. Spatial Variation of Biological Contamination of Soil from Najaf City. Indian Journal of Environmental Protection this link is disabled, 2020, 40(2), pp. 196
9- Almudhafar, S.M., Alattabi, I.A. Effect of environmental factors on drainage water network in Najaf governorate, Iraq. Indian Journal of Environmental Protection this link is disabled, 2019, 39(11), pp. 1050
10- Almudhafar, S. M. Environmental assessment of shut alkufa in Iraq. Plant Archives, 2018, 18(2), pp. 1551
11- Almudhafar, S.M., Abboud, H.A. Spatial variation of surface water contamination by heavy elements in Alhira relative to tourism. African Journal of Hospitality, Tourism and Leisure, 2018, 7(4)
12- K. R. Kadhim, S. Almudhafar, B. A. Almayahi, 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
13- IA Alattabi, SM Almudhafar, BA Almayahi (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.
14- Safaa M. Almudhafar, B.A. Almayahi and Hanan H. Jawad. Effect of Environmental Parameters on Soil Salinity on Plant. Volume 24, Issue 5, 2020. Pages: 4247-4253. Doi: 10.37200/IJPR/V24I5/PR2020140.
15- Abdil-Ameer Noor T., Almudhafar Safaa M., Almayahi B. A. Environmental assessment of solid waste collection sites in Najaf Governorate. International J. Ecomedical and Public Sciences, (IJEPS) 5 (4): 01-05 (2022).
16- Abyss, K. D., Almudhafar, S. M., Almayahi, B. A. The right of disabled children in Iraqi. International Journal of Health Sciences, 2022, 6(S4), 47269-47276. https://doi.org/10.53730/ijhs.v6Ns7.13129
17- Khalid R. Kadhim, Safaa Almudhafar, B. A. Almayahi. An environmental assessment of the non-living natural resources and the available capabilities and their investment in Al-Najaf Governorate. HIV Nursing 2023, 23 (3): 265-273.
18- Noor T.Abdil-Ameer, Safaa M. Almudhafar1, B. A. Almayahi. The Natural Characteristics Affecting the environmental pollution Contrast at the Center ofAl-Manathira District. International Journal of Academic Multidisciplinary Research, Vol. 7 Issue 1, January - 2023, Pages: 166-175
19- Huda S. Abdel Wahhab, Safaa M. Almudhafar, Ahmed S. Alalaq, B. A. Almayahi. Social Environment and Its Effects on Domestic Violence. Rev. Gest. Soc. Ambient Miami, v.17.n.7, p.1-14, e03536, 2023.
20- Safaa M. Almudhafar1, Noor Tahseen Abdulameer, Basim A. Almayahi. Environmental Assessment of Surface Water Contamination with Pathogenic Bacteria in the Manathira District Center, JCHR (2023) 13(3), 1067-1077.
21- Safaa M. Almudhafar, Russel Alaa Mohsen, Basim A. Almayahi. Environmental Assessment of the Impact of Water Pollution in the Bahar Al Najaf on Plants. JCHR (2023) 13(3), 1036-1046.
22- Safaa M. Almudhafar, Azhar Rahman Sweihi, Basim A. Almayahi. Spatial Analysis of Surface Water Contamination with Pathogenic Fungi Resulting from Sewage Sites in Najaf Al-Ashraf Governorate. JCHR (2023) 13(3), 996-1011.
23- Safaa M. Almudhafar, Noor Tahseen Abdulameer, Basim A. Almayahi. The Impact of Pathogenic Fungi on Soil Contamination in the Center oftheAl-Munadhirah District. JCHR (2023) 13(3), 1056-1066.
24- Hassan Abdullah Hassan, Safaa M. Almudhafar, Iman A. Al Atabi, B. A. Almayahi. Environmental Factors Affecting Surface Water in Al Mishkhab District. Migration Letters, 2023, Volume: 20, No:7, pp. 2 61 2 76.
25- Safaa M. Almudhafar, Maryam A. Rahim, Basim Almayahi. Spatial Analysis of Household Waste's Impact on Soil and Air Pollution. IJEP 44 (2): 52-685 (2024).
26- Samer H. KadhemAl-Jashaami, Safaa M. Almudhafar, Basim A. Almayahi. A Spatial Analysis of the Influence of Environmental Factors on the Growth and Proliferation of Pathogenic Fungi in the Manathira River. Kurdish Studies, 2024, Volume: 12, No: 2, pp.5450-5461.
27- Samer H. KadhemAl-Jashaami, Safaa M. Almudhafar, Basim A. Almayahi. The Effect of Climate on the Variation of Pathogenic Bacteria in the Waters of the Manathira River. Kurdish Studies, 2024, Volume: 12, No: 2, pp.2330-2341.