

التأثيرات البيئية والديمغرافية للتصحر في مدينة الديوانية

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Environmental and Demographic Effects of Desertification in Al-Qadisiyah Province

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تاريخ الاستلام: ٢٠٢١/٧/١٥

تاريخ القبول: ٢٠٢١/٨/٣

ABSTRACT:

Since mid-20th century, desertification is one of the most serious environmental problems that has economic and urban impacts on large number of world population. The major reason of this phenomena is the arid climate, shortage of water and the misapplication of natural resources especially in the rural areas. These factors lead to the disintegration of the associations between natural environment and its social, economic and urban surroundings.

The most important result of the study is that desertification problem is in continuous aggravation because of the indifference to its danger and its future effects in addition to the lack of environmental, agricultural planning and mismanagement of environmental resources. Also, there is no coordination between the ministries and the environmental, agricultural and water institutions. It is clear that the environmental effects are grave especially after the deterioration of biological cover and lack of biodiversity, and the increase of dust storms especially during the arid climate and heat waves in the last two decades. In respect to demographic situation, the economic and social reality deteriorate in the rural area of Al-Qadisiyah province due to desertification effects on agriculture. As a result, people start migration from the rural areas towards urban centers.

Keywords: effects, environment, demography, desertification and Al-Qadisiyah.

Introduction

Desertification is one of the most serious environmental problems that has economic and urban impacts that faces large number of world population especially in the marginal and semi- wet areas. This phenomena has turned several large areas into arid ones. So, desertification in its wider concept is the ability of desert and semi- desert conditions to expand towards the green and fertile belts to turn them into waste and arid lands. The process can be defined as the transformation of agricultural and productive lands into unproductive ones.

The process leads to environmental imbalance and disintegration of the relationship between natural environment and urban, economic and social surroundings. The result is that large areas of desert, semi- desert, marginal, wet and semi- wet areas are turned into desert. The reasons for this phenomena includes waterlogging, soil erosion or quick sand, which lead to death of plants or migration of living animals.

The study Problem:

- Did human factors play a role in desertification and environmental degradation in the study area?
- How can the aggravation of the phenomenon of desertification and its environmental and human repercussions be stopped?
- What are the most important immediate and future solutions to this deterioration?.

The Study Hypothesis:

Human factors as disinvestment of agricultural lands, lack of use of the modern irrigation ways, inability to apply modern and scientific rules of agriculture, lack of the agricultural development courses, inability to employ natural resources and absence of awareness of fragile biological ingredients in the dry and semi- dry regions. Life in these regions depend on scarce water resources especially in the time of global warming and climate change in the southwest of Asia in addition to the heat waves and dryness that lead to death of animals and plants as well.

The Study Goal:

- Knowing the human factors that cause desertification.
- Monitoring the environmental effects of this phenomenon.
- Finding drastically solutions to the phenomenon of desertification.
- Dissemination of the dangers of desertification phenomenon and its serious environmental effects.

The Study Tools:

The researcher depend on studying the reality of the problem and its dissemination through analyzing the data and the reasons of the problem. They work on mapping by using (GIS), satellite, aerial images and topographic maps. The researcher has drawn a new map for desert in the area of study. figure 1

The Study Approach and Structure:

The researchers adopt the analytical approach depending on the available data and information of the problem. They have analyzed the problem natural and human reality, the causes and effects. Moreover, they have studied the possible means to combat desertification and minimize its impact according to the conditions and type of desertification in the region of the study. The study includes an introduction, abstract and a list of references.

The Study Area:

Al-Qadisiyah province is the study area of this paper and it is about (8153 km²). It represents (1.8%) of Iraq total area and it is one of the small provinces. The population is about (1250169) person, where rural area people represent (%43) of the total province population (2015). It lies in the center of middle Euphrates area and in the south central of Iraq. It is situated between the two longitudes No. (42-44) and (45- 49) east and between circles of latitude No. (31-17) and (24-31) north , (figure 1).

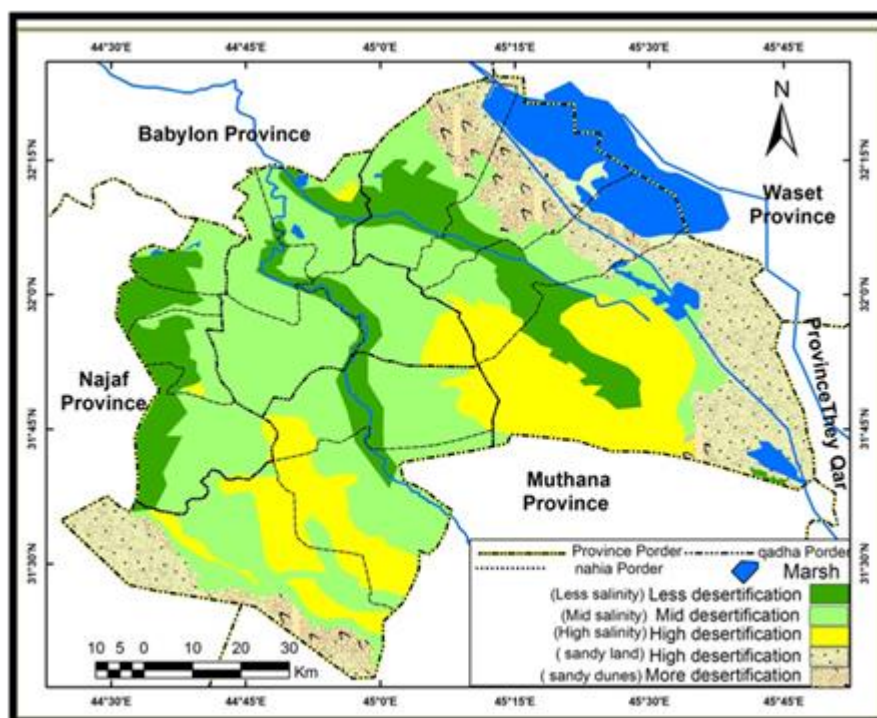


figure 1:Desertification Degrees

Source: The two researchers

The causes of desertification in Al-Qadisiyah province

First: Natural causes

- 1- **Climate:** It is one of the most effective factors of exacerbating desertification problem in Iraq in general and the study area in particular. The reasons of this phenomena are its desert, hot and arid climate, which is extreme and has annual and daily long heat scale in addition to rain scarcity and fluctuation for several years that is called (drought waves). These waves strike hot continental subtropical regions including Iraq especially after global climate changes that affected the marginal regions of poor biological layer. In the last 20 years, maximum and minimum temperature and its annual rates increased. Minimum temperature increases (2-3 C°) and the maximum increases (1.5- 2.5 C°), which is extremely high increase(Grainer,1990:9). Since the last decade from 2005, maximum temperature has increased to (47-51 C°) for (40-60) days per year. These temperatures are very high that accompanied by hot, dry wind, an increase of evaporation and transpiration, which

lead to death of green parts of most fruit and palm trees. That is why most houses set net above gardens and nursery to protect them from heat during June, July and August.

The severe conditions lead the farmers to abandon their lands during Summer due to drought and abandonment of land causes desertification and the increase of salinity. It is worthy to mention that all desertification reasons are related to climate and its effects.

- 2- Desertification starts during the drought period that strikes African coast from (1968- 1973) that includes the area from Mauritania to Mali, Niger, Chad, Ethiopia, Sudan and African horn. Drought is defined as the rain falls less than expected or the normal levels for a long period of time that leads to decrease water of certain environmental activities or groups(Grainer,1982:4-5). Moreover, it may result from water evaporation due to high temperature, wind, vegetation cover, type of soil and its ability to store water in addition to sufficient supplies of groundwater. So, all reasons of drought including (scarcity of water, high temperature, decrease of relative humidity, severe dry wind and increase evaporation-transpiration). Cerographists can identify drought through(DeMartonne) law to get drought coefficient.*

If (A) value is less than (5), the climate is drought (Saharan) as in the study area. It can be said that if the annual rain of the areas is less than the annual evaporation, they are arid ones. Semi- arid and arid climate is the one that annual rain is less than annual evaporation and this is called permanent drought while if rain is less than evaporation in some months of the year, the arid is called seasonal one.

The arid region according to (Koppen) is the one that does not have running water in the same region but it depends on other sources. Identifying arid climate depends on temperature. If the total annual rain (in cm) is less by two time of the annual temperature (in C°) and the rain is in winter, the region will be called an arid one(AL-BANA,2000:63). the latter is applied on the study area.

Aridity Categories: It is divided into four types (AL-SHIMMARY,2017:20-22).

- 1- Climatic aridity.
- 2- Agricultural aridity.
- 3- Hydrological aridity.
- 4- Economic and social aridity.

3- **Weathering and Erosion:**

In the arid and semi- arid areas, the earth surface undergoes weathering as weather elements like wind, rain, sun radiation and different temperatures, which lead to breaking down of lithosphere then erosion of soil. Erosion process is more inclusive than weathering process because erosion, beside weathering, it transforms sediments and fragments by wind through ablation process. The most dangerous result of desertification emerges during this stage when agricultural soil is eroded and sand dunes are formed to start their motion to neighboring areas(UNESCO,2014:17). Picture (1) east of province.

The problem of erosion is aggravated for several reasons as a result of climatic changes including severe heat, aridity and lack of water, which lead to break down of soil and lose its minerals. All these reasons accelerate weathering and wind erosion processes in addition to erosion due to sudden floods because of showers for hours.

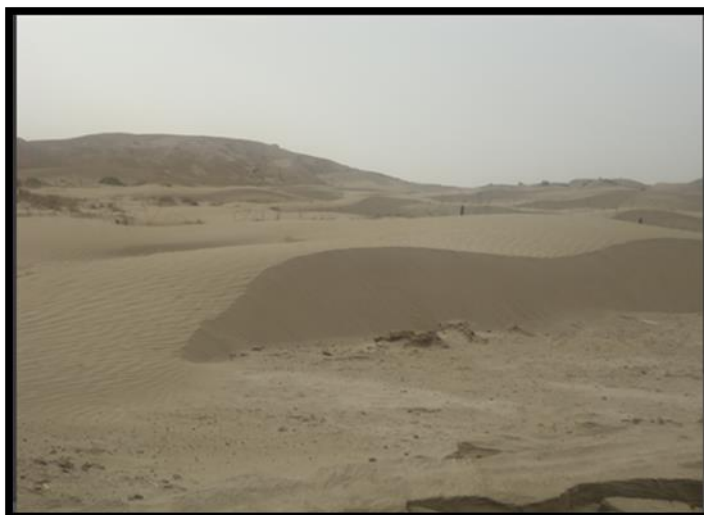
4- **Water resources:**

The sources of water in the study area are three:

- Rain: The rain falls during the period Oct. to May and the annual total of rain is (114 Mm.), and this is the average from (1941-2008). As for the total of rain during the last decade, it declines by (95 Mm.) annually (MOSA,2002:27-28). As a consequence of drought waves and climatic changes, Iraq annual rain average is declined along Tigris and Euphrates basins. The most inflicted areas are African coast and southeast and middle of Asia. Several seasonal rivers dry and even great rivers dry during certain seasons(AL-SAMARAY,2008:153-255). This is what expected to occur for Tigris and Euphrates in the 2040's and 2050's of 21st century due to climatic changes, Turkish projects and continuous pressure on water from neighboring countries. IbrakHeld has confirmed that African coast, African south Sahara and southeast

regions will be the most arid areas. Rain will decrease below its average by (30%) of the 20th century(AL-SAMARAY,2008:17-18). The weather stations in Tigris and Euphrates basins, for example, in (Erzurum) in Turkey, it was receiving (809 Mm.) for the period (1990- 2013). The average of annual rain in Ahvaz station in Iran decreased from (300 Mm.) in (1960- 1990) to (267 Mm.) for the period (1990- 2013). Also, the quantity of rain decreased in (Al-Riqa) in Syria from (350 Mm.) for the period (1960- 1990) to (290 Mm.) for the period (1990- 2013). In Zakho in Iraq, rain decreased from (630 Mm.) for the period (1960- 1990) to (580 Mm.) in (1990- 2013). In AL- DIWANIYAH station, rain decreases from (115 Mm.) to (98 Mm.) for the above periods(JUDY & WILKINSON,1985:62-74).

The decrease of rain falling on weather stations in Tigris and Euphrates basins, which are the main source of water for economic activities in the middle and south of Iraq means that the study area will have shortage of water. Turkey has implemented G.A.P project, which has a direct effect on life in Iraq that prevents great amount of Tigris and Euphrates water. Water discharges of Tigris and Euphrates minimized from about (80 billion m³) annually for the period (1940-1990) to (55- 60 billion m³) after (1992). It is likely that climatic changes and the drought waves contributed to decrease water level. The expected amount of water to reach Iraq after the two coming decades may be less than (40 billion m³) annually. This quantity of water is very small especially after the increase of population from (16) millions in (1986) to (38) in (2017). It is expected that population reaches to (30) millions in (2030)(AL-SHIMMARY, 2017:22).



Picture. (1) sand dunes in eastern part of Al-Qadisiyah province

It means more need for water, and the features of water scarcity start during Summer, which affect agricultural and economic reality in the study area. The area of Summer crops diminished to (50%) especially for rice crop that the population of (AL-SHAMIYAH) district depends on as a main source of income and affects their living standard negatively.

- **Surface water:** the map of surface water in the province covers the whole area. There are three streams running through the province from the north to the south. On the west side of the city, AL-SHAMIYAH river, which is one of Euphrates branches runs through the city, AL-DIWANIYAH river, which is a branch of AL-HILLA river runs in the middle of the city. AL-DAGHARA river runs in the east of the city, which is the second branch of AL-HILLA river. Tens of canals cover large areas in addition to several canals from Tigris river to irrigate large areas in the southeast of the province. The abundant availability surface water affects negatively on the soil and leads to waterlogging and soil salinity.
- **Groundwater:** Despite the great quantities of groundwater, most of water is unfit for use due to salinity except for limited number of days during the year.

5- **Terrains:**

Earth surface is the area that all geographical, natural and human phenomena are distributed and interact to show the economic

activities and population distribution in the study area. The surface of the study area is part of the sedimentary plain, which is very plane. The surface slope is from north to south and most areas are (10- 24 M.) above sea level except limited area in the southeast where elevation is (20- 55 M.), which is part of the western plateau. The extreme planeness of soil has prevented natural discharge of excessive water. In the eastern part of the city, the average slope of land is (1M.) for each (700 M.), and (1 M.) for (10000 M.) in the west. This affects the natural discharge of groundwater, where it appears in the lower parts of land or around roads and leads to waterlogging and salinity of large areas(**SASHI:1-2**).

Salinity phenomena has covered large areas of the study region due to the lack of drains network or the existed one is ineffective so the drains become another source of salinity. Moreover, many non-concrete lined canals lead to salt accumulation in the soil, which is one of the most prevalent examples of salinity because it affects the physical and chemical properties of soil, which in turn affects crops and productivity negatively. Salinity expands over wide area of the study region, and it has three levels of salinity based on their chemical compounds, sodium chloride, magnesium or calcium. Such types are called (swamps), and they have been located through analyzing satellite images. Swamps expand over north of AFAK, west of AL-DIWANIYAH in AL-SHAFIYAH sub-district in addition to AL-HAMZA district in (UMALAKAF) island between AL-SABIL and AL-ATSHAN rivers.

The second type of salt is called (AL-SHORA), which constitutes of sodium and magnesium sulfates. It takes the form along irrigation canals as seen in the western and southwestern part of AL-DIWANIYAH, near AL- DAGHARA river especially in AL-HURRIA canal northeast of AL-DAGHARA, and east of AL-HAMZA in AL-SADEER sub-district in particular (**BOSTEL,1998:11**).

The rest of lands are moderate and they are subject to be extremely salt if not cultivated or reclaimed.

6- Soil:

The study region is part of sedimentary plain that is formed by Tigris and Euphrates flood deposits and seasonal running vales in addition to wind

deposits. Though sedimentary soil is the most fertile type in the world, the mismanagement and disinvestment especially after building dams and controlling water flow lead to increase the level of groundwater. Moreover, lack of drains or land reclamation aggravate salinity problem since the soil is waterlogged and salts sedimented by capillarity mechanism on the soil surface. Sandy soil that is expanded due to desert conditions, drought, lack of rain, high sun radiation and thermal expansion. All these conditions lead to the emergence of sandy desert soil, which is one of desertification phenomena in the study area. These kinds of soils cannot be saved from desertification unless strategic plans are set to reclaim, provide water for irrigation and improve their natural and chemical properties. If the problem is untreated, the problem will expand over large areas in the east and south of the province.

Also, the soil pans expands in the western part of AL-SHAMIYAH on the remains of IBN NAJIM and MABKHRAT AL-NASUR marshes, which are dried up in the 1980's. The soils of the two locations are clay soil of bulky texture and low porosity. The soil has high groundwater and bad drainage, where salt is high about (20-45) ppm/cm(AHRAM,2005:2).

Second: Human Causes of Desertification:

As seen by some researchers, the real causes of desertification are human factors. This fact is accurate in wet and semi- wet environments, which are rich in their water resources. But the arid and semi- arid desert environments including study area are considered the first natural factors of desertification problems. Moreover, the traditional methods of agriculture have contributed to the emergence of this problem. The human reasons will be highlighted in details as the following:

- 1- **Using traditional irrigation ways:** dipping and surface irrigation are among these methods in which the land is irrigated by great amount of water four times more than its need. Most of water lost in leakage or evaporation. In both cases, they will lead to desertification since leakage increases groundwater levels and the fluctuation of the groundwater levels will accumulate salts on the soil surface through capillarity mechanism in addition to evaporation of water. This problem cannot be handled only through using duty water for each crop and using modern irrigation

methods like (sprinkle, drip and subsurface irrigation) in addition to land reclamation, establish drainage system and lining canal to minimize leakage of water to the neighboring lands.

2- **Traditional agriculture:** Farmers in Iraq are still using traditional methods except some limited experiences. There are several reasons behind the decadence of agricultural sector in Iraq. This fact does not need an evidence to support especially in the study area, where crops and fruits productivity is less than (25- 50%) as compared to the advanced countries or those countries that have seen real agricultural development. For example, in the study area, the average productivity of a (donum) is no more than (400 kg/donum) while in the advanced countries and Egypt is more than (1250 kg/donum). What is important in this point is the effect of agriculture method on increasing desertification problem through the following:

- 1- The absence of efficient irrigation and drainage systems. Also, the random irrigation and drainage networks that farmers make without paying attention to their technical specifications, depth and numbers. This phenomena occurs in the rented lands where the farmer digs his canal on his expense.
- 2- The soil is stressed and the chemical and organic fertilizers are not used in proper and scientific manner. Each crop has certain types of requirement regarding soil and fertilizers also each stage for development needs certain fertilizers and pesticides. For example, compound fertilizers are used with the crop seeds, and (Urea) when plant grows for green parts. Because of the limited agricultural awareness, the economic conditions, bad-planning and unreal agricultural policies, the farmers do not get the fertilizers in their proper time or irrigate in the suitable time due to corruption and exceed water rations. Many farmers have large areas but because water does not reach in time, these lands turn into barren especially those cultivate in the ends of the irrigation canals.

Due to deterioration of farmers' living standards and the failure of agriculture economically, they do not cultivate any crop and sells fertilizers and seeds received from the government. The reason is that water ration is not guaranteed in proper time or the

government may not buy his crop, which makes the framers distrust the government's intention. So, the farmers look for new job opportunities or sell the crop as green fodder to get the minimum level of profit and pay the cost of seeds and fertilizers.

3- **Overgrazing:** Raising animals is the farmers' second agricultural activity. Because of the deterioration of agriculture, foreign competition and the high cost of cultivating crops, many farmers depend on raising animals. This kind of shift comes because raising animals is profitable activity. So, farmers turn to raise sheep, cows, goats, buffalos and camels. The number of animals is (402368), (93308), (78888), (13329) and (10092) respectively. This statistics are the official counted animals of AL- DIWANIYAH directorate of agriculture until (15/11/2014). It means that there are more than (600000) of productive animals. This number is big and it needs pastures and green and dried fodder. It is known that the farmers' cultural level does not enable him to practice raising livestock in a closed and fenced place. The farmers depend on raising livestock in the open pastures, which makes animals roaming in the arid pastures, where nothing grows except the thorny desert plants as ALHAGI, quack grass, tamarisk and schanginia. Most of these plants are hard and low in their nutritional value. During Winter and Spring months, rain falling helps some annual plants to grow like malva, barbarum, caper bush, borage and shamrock(AL-SHIMMARY,2016:79-89). Overgrazing means to let animals uproot these plants before completing their life cycle and this process leads to the appearance of two phenomena that destroy soil:

A- Overgrazing in the sandy areas leads to soil ablation, which forms sand dunes and sandy and dusty storms.

B- Grazing livestock in the wet clay soil results in destroying it. When the soil dries, it will become hard and do not have porosity that makes it hard to cultivate crops.

Another negative phenomena has appeared in raising livestock that is the farmer cultivates his land into pastures and used as fodder. The farmer does not need high costs for good ploughing, fertilizers and pesticides.

Even he does not more than one or two times of irrigation. This phenomena will destroy large areas of good lands.

4- **Weak Management of Environmental Resources and Ineffective Agricultural Policies**

Weak management is the prevailing feature in under developing countries including Iraq. Iraq has huge natural and human resources but mismanagement and disinvestment of these resources have led to reverse results that are hard to fix. This aspect is applied on soil, water and biological layer mismanagement. The negligence of these resources may lead to the emergence of all forms of desertification as salinity, waterlogging, quick sand and erosion. Also, life cycle in any environment is related to water, soil, management and investment of these potentials. So, this is reality of environment of the study area. All the above mentioned reasons in addition to management and financial corruption have paralyzed agricultural offices to implement agricultural plans. These offices are unable to prevent transgression of water ration. Also, the offices are unable to preserve fragile vegetation cover. For example, before (2003), there were (8) man- made forests of different areas but the total area was (19190 donum). What is left after that is (817 donum) only(**REPUBLIC OF IRAQ,2014:15**).

The most serious issue that aggravates desertification problem is using main drainage water* that flows across the study areas from the east to the north. This water is salty and it is a gathering of agricultural projects in addition to return the drains water to irrigation canals. Moreover, waste water is thrown in the fresh water, which becomes dangerous on Tigris and Euphrates fresh water, where pollution levels are very high and dangerous due to high quantities of waste water and less released water for the two rivers.

5- **Other Human factors:** There are certain human practices and activities influenced directly or indirectly on desertification problem including:

A- The call for digging trenches around some locations of the study area or other provinces for security reasons will yield millions of tons of dust and dirt, which will be subject for wind, weathering and ablation.

B- In the time of absence of government authority especially in the agricultural offices, many irrigation canals, drains and waste water have been transgressed, where unsystematic canals and drains are dug that have negative effects on soil.

C- Throwing city debris and hard pollutants in the rural areas leads to pollution of groundwater and soil.

Second: Desertification Effects and how to Combat it:

1- Desertification Effects: The prevalent desertification manifestations in the study area are:

A- Soil Waterlogging and Salinity: waterlogged and salty lands are varied in the study area, which is about (1628317) donum, about (49%) of the total area in which (6%) is less salinity, (34%) medium salinity and (60%) is severe salinity (**AL-SHIMMARY,1997:220**). Salinity affects land productivity greatly. Extreme salty soil production is (zero), very salty soil production is (0- 40%), medium salinity (40- 70%) and non- salty soil production is (100%) if other elements are available like water and fertilizers (**RISAN,2002:97-101**). As for waterlogged land, the area is about (30000- 40000) donums in the west of the study area in the remains of IBN NAJIM marsh, where two different environments existed together; AL-DALMAJ marsh and sandy desert area. The other preservation is in AL-SHAMMIYAH district, which is wet environment with high population density who farm their lands. The fourth reservation is in AL-HAMZA district in southeast of the province called (MABKHARA AL-NASUR) on the borders of DHI QAR province.

B- **Sand Dunes:** sand dunes affect the land they move to by the help of wind, which erodes the areas the wind passes by. Sand dunes effect increase when the weather is dry and wind speed is high, which affects large areas in the east and southeast parts of the province. The area that is affected by this phenomena is about (990000) donum, and it represents (30%) of the total studied area. This sandy area is of great negative effect on agricultural production that raises dust during windy days. The dusty storms period is (250) days in a year. This dust and storms have impacts on agriculture, man's health and all other living creatures in addition to drought waves, lack of rain and overgrazing.

2- **Environmental Effects of Desertification:** Since desertification is prevalent in the arid environments, where lack of rain, high temperature, scarce of water resources and mismanagement of environmental resources, so large areas of the province lands lost the living elements of the biological layer. To fix this problem, man has to interfere positively starting with environment and ending with total reclamation of desert- like areas to prevent the collapse of environment. International and local reports confirm that the decrease of biodiversity is more than (30%) since half a century. This severe decrease especially in the tropical areas is about (59%) and (41%) of ecological systems for fresh water (GETIS & JEROME & DFELLMAN,2008:106-107).

The shortage of biodiversity has serious impacts on environmental systems that lead to environmental imbalance that is hard to regain. Moreover, environmental imbalance threatens food security, medications production, pollination, pollutant filter and protection from natural disasters beside its tourism and recreational importance. For example, drying out marshes in the south of Iraq in the 1980's has catastrophic environmental impacts on biodiversity. The marshes were rich in their animals including fish, birds, natural and agricultural vegetation. The changes are serious on this wet environment that turned into arid land and a source of dust and pollution.

3- **Economic and Social Impacts:** poor environmental systems and destruction of resources have dangerous effects socially and economically. For example, drying out marshes in the south made thousands of population to migrate their environment, which is rich of its resources including fish, birds, rice, buffalos, mats, fodder and paper manufacturing in addition to the pollution that is inflicted fresh water in Iraq especially in the south and middle of Iraq. Millions of cubic meters of untreated waste water, industrial pollutants and medical waste are thrown in the river that makes water unfit for fish or other civil use. This problem has led to increase the cost of water treatment, spread of diseases and poisonous materials through crops or fish that live or irrigated by this water.

The destruction of environmental system, soil fertility and its low production, and pollution in the desert- like areas lead to the

migration of people from rural areas to the urban ones or any place that they will get job opportunity and descent life.

The decrease of genetic diversity in the natural ecological systems or in the crops production and livestock will have grave impacts on population of rural areas. The disappearance of the genes that are inherited since thousands of years especially under badly planned development programs and government policies will worsen the issue. Because supporting the (supreme) breeds will result in more decline of genetic diversity. A study has shown that (38%) of chicken, (36%) of cattle types, (33%) of sheep and (15%) of goats are endangered species of extinction (**MALIK & KAMAL,2002:192**).

This is problem aggravates under current weather changes, shortage of funds, excessive and unsustainable exploitation, and the effect of strange and the invasion of strange species. The latter is a great threat in most of world environments but not in the study area. But the most dangerous source of threat for biodiversity is the excessive use of chemical fertilizers and pesticides, which pollutes irrigation water in turn it is conveyed to crops then to groundwater or through irrigation water to the main rivers because some drains are not re-pumped to the main rivers (**MINISTRY OF ENVIRONMENT OF IRAQ,2011: 51**).

The accumulation of chemical materials used in fertilizers is the first danger of the ecological systems. European Union attempts to face the issue of Nitrogen accumulation in the ecological systems through managing sources of pollution. Most of sources of nitrogen accumulation is agricultural that makes the combat harder than industrial pollution. Several measures are taken to limit leaking Nitrogen from the soil to water canals including(**AL-KHATIB,1987:3**):

- 1- Limit the use of chemical fertilizers and natural one (manure) based on analyzing the real need of soil.
- 2- Use the method of crops rotation, and soil winter cover, which are fast- growing crops cultivated between other crops to prevent washing nutrients of the soil.
- 3- Storing natural fertilizers (manure) properly.
- 4- Good management of soil.

The study has shown that whenever fertilizers use is decreased, it will be a positive factor. Nitrogen use is minimized for each hectare. In Holland, fertilizers use is decreased from (350 kg/ hectare) in 1990 to (220 kg/hectare) in 2005. In Belgium, the size of Nitrogen use is dropped from (270 kg/hectare) to (190 kg/hectare), and in Denmark from (180 kg/hectare) to (120 kg/ hectare). The rest of the countries of Economic and Development Organization like Sweden and Spain, they use less than 100 kg/ hectare).

In AL-QADISIYAH province, the use fertilizers and pesticides are not employed by technicians or specialists. The farmers use depending on the seller's directions or the leaflet. Many of farmers believe that using more quantities will have positive effects, and this is wrong assumption and is called nutrients pollution.

Through reading several papers that show the use of fertilizers and pesticides use has positive revenues, but for a long term use it has negative aspects for the environment **(MINISTRY OF ENVIRONMENT OF IRAQ,2011:32).**

The economic, demographic and social impacts will result in the collapse of agriculture, livestock in the desert- like areas. These impacts will motivate population to migrate to other places for new sources of income. Also, the low level of income in the new areas will make population suffer of the new reality that lacks social services and infrastructure. \in order to fight desertification, the process needs huge funds since reclamation processes need specialized companies.

Most of time, the researchers link between poverty problems and desertification and between deterioration of land resources especially in the arid and semi- arid environments**(RISAN,2002:95).**

- 1- **Desertification Combat:** the term as stipulated in the international agreement of combating desertification (1994) is all activities, which are part of integrated development of lands in the arid and semi- arid areas and drought and wet areas for the sustainable development that aims to prevent or lower the deterioration of lands and rehabilitate the lands that are partially deteriorated or reclaim the desert- like lands. The term of lands (Land biological productive system) includes soil, vegetation, living organisms and other ecological processes within the system.

To regain the desert- like land fertility and maintain population's life in their environments is a hard process and needs strategic plans depend on scientific studies. The process starts with making a survey for the province lands, classify them according to its fertility, salinity degree and types of desertification. Then, priorities are set to prevent deterioration of marginal lands and desert- like lands. The extension of desertification on non- desert areas will double the cost of reclamation. So, the plans should be long- term ones with wise management of natural resources and have the comprehensive vision that includes demographic, economic and social aspects.

The process of combating desertification will be summarized with focus on the most important two reasons as shortage of water and soil salinity.

First: Handling mismanagement, shortage and wasting of water

Water is the essential part of life in the arid and semi- arid areas. The unwise management of water resources leads to increase desertification problem. Some areas use traditional irrigation methods like immersion, which is a great waste of water. Water leaks to the nearby lands to waterlog them then turns into salty lands. While there are other places where suffering from shortage of water. Consequently, agricultural activities will be limited in other areas and in turn lands become desert-like ones. The key solution is water resources management based on investing water scientifically, and this cannot be achieved only through:

- A- Using modern methods of irrigation as sprinkling and dripping, where these methods decrease waste by (50- 70%), maintains soil fertility, utilize fertilizers, and prevents waterlogging and salinity because of the topographic conditions and less slopes lead to lack of natural drainage.
- B- Prevent water resources pollution through national strategy depends on strict legislations and laws since all entities that throw untreated waste water in fresh rivers are governmental departments or at least they know these departments.
- C- Lining main and secondary irrigation canals because canals water levels is higher than surrounding lands and may leak and aggravates waterlogging and salinity problems.
- D- Development of groundwater and utilize arable water to cultivate plants that resist salinity and drought.

E- Land reclamation and rehabilitation is an urgent need because salty lands are unfit for cultivation or limited in productivity, which makes the process of reclamation is an urgent need. Reclamation starts with survey, extend irrigation and drainage network, and level lands. Then the process of planting lands starts then washes to be fit for cultivation. The last process is the stage of establishment of services, building and agriculture production.

The existence of integrated drainage system that provides water for irrigation without waterlogging or salinity and maintains environmental system is essential for population settlement. Moreover, the land reclamation will help prevent sands from extension towards agricultural lands and soil erosion.

F- Halting sands using clay soil, some types of asphalts, fences, barricades and wind deterrents to minimize wind speed or use heavy clay soil to stabilize sand.

G- Overgrazing and wood gathering of long- lived trees should be stopped and try to gather and plant their seeds in other humid soils.

H- Revise unsustainable agricultural development plans that have negative impacts especially hiring large areas that are irrigated by the salty water. To succeed any agricultural plan, there are certain conditions that should be available including the basics of sustainable development that balance among the social, economic and environmental goals and benefits. Investing environmental resources without sound plan to maintain and sustain them are among the main reasons of desertification. This leads to decrease land productivity and deteriorate population economic situation. So, there shouldn't be any approval for agricultural, industrial, touristic plans in the rural areas. The plans should include environmental development and preserve resources especially water resources, soil, biological layer and biodiversity. Also, the plans have to consist of certain mechanisms and laws to follow up projects and plans to ensure environment protection and its resources. Moreover, scientific approach should followed to handle environment because any misuse or disinvestment will result in catastrophic consequences on environment.

- I- Adopt non- reversible methods of ploughing in the sandy soils and abandon the classical methods of reversed ploughing. The following ploughs should be used(NAHI,2009:178):
- Using Roster to plough land about (20-22 cm) after harvest directly.
 - Soil Spiker to prepare natural flat land of crops waste.
 - Chisel plow to plough minimum tillage (8-12 cm) in the areas subject to erosion.
 - Multipurpose seed drills to prepare all other process of seeding, fertilizing and covering to minimize mechanical effect on soil structure. In north Kazakhstan, the experiments have shown that following this system will maintain (85%) of crops waste, which ensures high protection for soil of wind impact.
 - Strip cropping as a method of maintaining soil of wind erosion. These strips can be applied as the following:
 - In heavy lands, the land is divided into rectangular strips with the direction of the wind. The strips are planted with erosion- sensitive crops like corn and sunflower. Then, uncultivated land is left successively with the cultivated one(UN,2010:24-27).
- J- Shelter belts cropping: it is agricultural belts made of annual trees or plants of (1-2 m) in wide. These barricades protect soil and crops from wind and maintain land humidity and fight drought.
- K- Apply agricultural and balanced rotations since they are the best means to maintain soil fertility and combat wind erosion. Crops rotation should be in harmony with soil type and crop. For example, quadruple agricultural rotation like crops on strips- grains- quack grass or legumes for two years or quintuple rotation.
- L- The use of salty water of drains and main drainage without any scientific study or how to use it. The experiment succeeds in the east of the province especially in the sandy lands because of high infiltration of land does not make salts accumulate on the soil. So, the use of this water should be according to scientific conditions like underground infiltration, possibility of water discharge in addition to deep underground water. Based on these facts, the areas that do not have such conditions are subject to desertification within few years.

- M-The reuse of waste water whether it is agricultural or industrial should be treated and never returned to the rivers but can be used directly for irrigation purposes to water trees or man- made forests that minimizes the effects of sand or dust storms.
- N- Increase the soil ability to maintain water especially in the sandy soils like using crashed environmental coal to the soil surface. Also, minimize water waste by putting insulation layer underground and leaving gaps for each (150 m) to drain water.
- O- Minimize water evaporation through natural or industrial surface covers like paper, plastic, asphalt, gravel and porous nets of 5-25 mm.
- P- Paying attention to tree- planting and natural grazes due to their role to maintain soil, minimizing wind speed, soil humidity in addition to environmental and recreational importance. In respect to tree- planting, there is a belief that green belts is unrealistic suggestion and expensive because of the area of the belt will be large, much water is needed and other administrative expenses. So, the realistic proposal is to commit farmers to plant fruitful drought-resistant trees like palm- trees, olive and almond or unfruitful ones like tamarisk, wild thorn, willow, Eucalyptus and Conocarpus along rivers or smaller streams. Some trees can be planted along drains because these trees can grow in salty water(**AL-SHIBANY, 2011:44**).

As far as developing natural grazes, though the province does not have that such much rain, rain during winter and spring helps to grow many annual plants. But disorganized grazing or overgrazing lead to kill these plants before their full growth of complete their life cycle. So, plants are uprooted in the graze and lead to poor biodiversity. The agricultural departments have to interfere according to certain plans to develop natural grazes through collecting seeds of desert plants and sow in other places making use of salty groundwater especially in the areas of sandy soils. Also, small fenced areas should be established within natural grazes to grow desert and semi- desert plants to gather seeds then grow them in the open grazes(**ABOUD, 2006:53-77**).

Moreover, natural reservations should be established to maintain biodiversity in the study area and choose four regions; two in AFAK district and one in AL-SHAMIYAH and the last one south of AL-

HAMZA district. The two regions in AFAK district are (45%) of the province area and there are two locations, AL-DALMAJ marsh and the desert sandy area. The other reservation of AL-SHAMIYAH district is a wet environment that has high population density who depend on agriculture and the fourth one is in AL-HAMZA district.

Conclusions:

- 1- The province semi- arid climate and its continental features, lack of rain, fluctuation, drought waves especially the climatic changes of negative effect on the province. The average of maximum and minimum temperature during the last two decades in comparison to 3-5 previous decades.
- 2- Aggravation of agricultural and climatic drought reflect negatively on the problem of desertification in all its types, which weakens land productivity and fertility in addition to waterlogging, salinity and sand. All these aspects have direct and serious impact on economic and social reality in the province that is called economic and social drought and leads to migration rural areas population.
- 3- The province in particular and Iraq in general since (1992) start to face real problem related to fresh water supply. It is expected that the problem will have more dangerous effects especially during the next three decades. Because the water supplies of Euphrates and Tigris decreased from (8 billion/m²) before (1992) to (55-60 billion/ m²) during the current decade and this quantity is very small as the growth of Iraqi population will reach to (53) million in (2030) in comparison to (16) million in (1987). This hydrological reality will definitely lead to environmental, economic and social disasters including the most dangerous one that is desertification.
- 4- The study has shown that human reasons have great impact on maximizing desertification problem as (mismanagement of natural, environmental and economic resources, traditional irrigation methods and traditional agricultural methods). Also, the decadence of agricultural planning and policies that result to aggravate agriculture problem.
- 5- In addition to the economic and social effects of desertification that leads to migration of rural areas population to other cities. Many of the areas are turned into arid area and empty of life, where they lack biodiversity and extinct of species or immigrate to other

environments. This situation causes environmental imbalance and destruction of environmental systems that are hard to get back in addition to its effect on food security, crops pollination and pollutants infiltration. What aggravates the problem more is the use of much chemical fertilizers, pesticides and poisons in random way.

In light of the topics discussed in the study as the causes of desertification, effects and steps of fighting it, the study also includes the measures of facing lack of water, land reclamation, adopt sustainable agricultural plans to achieve economic, social and environmental goals. The focus is on maintaining environmental and natural resources, managing, sustaining and maintain them as a right for all generations. Desertification combat includes methods to stop sand, how to use salty water and gray water to fight desertification in addition to the methods of preserve biodiversity, develop grazes and establish natural reservations.

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