Environmental and Climate Deterioration in Nineveh Governorate Tel Abtah District as a Model.

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Abstract. The decrease in the amounts of rainfall in the dry and semi-arid areas, which are fragile environments, the recurrence of the drought Phenomenon for successive years, and the irresponsible Practices of the Population lead to the deterioration of the soil and its characteristics, the decline of Vegetation cover, and the transformation of lands from Productive agricultural, residential or Pastoral lands to barren and decertified lands, including the lands of Tel Abta district. Which became clear manifestations of desertification in large areas of them. The research aims to study the deterioration of soil, Vegetation covers and sand dunes, which began to creep into residential and agricultural areas and natural Pastures, which led to the migration of the inhabitants of those Villages to Other areas and these lands became decertified environments repelling Various human activities, especially agriculture and grazing. Then the research concluded with conclusions and suggestions.

1. Introduction
The decrease in rainfall amounts in dry and semi-arid areas, which are fragile environments, the recurrence of the drought Phenomenon for successive years, and the irresponsible Practices of the Population lead to the deterioration of the soil and its characteristics, the decline of Vegetation cover, and the transformation of lands from Productive agricultural, residential or Pastoral lands to barren and decertified lands, including the lands of Tel Abta district. Which became clear manifestations of desertification in large areas of them.

The research aims to study the deterioration of soil and Vegetation cover, which spread in agricultural areas and natural Pastures, which led to the migration of Villagers to other areas and these lands became decertified environments repelling Various human activities, especially agriculture and grazing. As well as finding the necessary solutions to this Problem and limiting its spread to stop the environmental deterioration therein. It is determined by the aggravation of the Problem of land degradation in the study area as a result of several factors that affected the environmental reality, most notably the soil and climate in the study area. This has resulted in many Problems, the most important of which is desertification and the decline of Vegetation cover, which requires serious study and confronting and minimizing these Problems. The research hypothesis is determined by:

1. There are natural and human causes that have contributed to the deterioration of land in the Tel Abta sub-district
2. The Possibility of reducing the Problem of soil degradation by following scientific methods.

The importance of the research stems from the fact that land degradation is a major and increasing Problem, especially in the study area, which requires standing and studying this Problem and finding appropriate solutions to it.

The research relied on the inductive method to reach the goal of the research, as well as the use of modern technologies.

1. Geographical information systems techniques represented by (ARC GIS 10.4) and digital model data (DEM 30 M)
2. The Map of Iraq’s exploratory lands with a scale of (1/100000), issued by the Ministry of Agriculture, Directorate of Agricultural Research and Projects, Bjorn for the year 1957.

In order to reach the goal of the research, it was divided into three sections. The first topic included: the natural factors affecting land degradation in the Tel Abta sub-district, while the second topic dealt with the causes of land degradation in the Tel-Abta sub-district, while the third topic came to study the methods of reducing land degradation in the Tel Abta sub-district, and then concluded the research with conclusions and sources.

2. Materials and Methods

2.1. The natural factors affecting land degradation in the Tel Abta sub-district

2.1.1. Location

The study area is located within the administrative borders of Nineveh Governorate and extends from its center to its south between two latitudes (34,8521 - 36,2134) in the north and arcs of length (41,3612 - 42,8471) in the east. It is bordered on the north (Al Mahlabiya district, the center of Tal Afar district, and Al Qayrawan district), on the south (Al Anbar district), on the east (Al Shura district, and the center of Hatra district), and on the west it is bordered by (Al Ba’aj district), map (1). It has an area of 5188.86 km².
2.1.2. Surface
The surface of the study area is characterized by flatness in most of its area and descends to the east, and the altitudes range between (170-283) meters above sea level.

Map 2. Surface appearances in the study area.
Note: 1/30m Digital Elevation Model (DEM)

The most important sections of the surface in the area of Tel Abta.
A- The range of the Plains: The range of Plain lands spreads in most Parts of the study area, especially in the northern and central Parts, extending to the south, and its height ranges between (210-275) m above sea level, and includes approximately 70% of the area of the study area. Wind and sand dune formation.
B- high lands range: They are found in specific areas in the extreme north-west and far south-west, and their height ranges between (276-319 m) above sea level, and their Proportion reaches 7% Of the area's area, and it is an extension of high hills outside the study area.
C- the lowland area: They are lands that define the range of Valleys located in the neighboring land and include some small Valleys that extend to the east in order to form a network of larger valleys, including (Wadi Al-Brit) and (Wadi Al-Majma’a), which form Wadi Al-Tharthar. And the network of Valleys (Al-Mada) and (Al-Hawizia) that make up Wadi Al-Ajeeg, which extends from Sin jar to Al-Ba’aj. There are also depressions within the study area or Part of it, such as the (Sanisila and Al-Ashikar) depressions, which are filled with sediments, sand and rain water in the winter season and are dry in summer. This range occupies approximately 22% of the area of the study area [1].

2.1.3. The Climate
The climate of the study area is characterized by an increase in the number of hour's of solar brightness, which reaches an annual rate of (12) hour's during the study period from (1993 - 2020) and an increase in the number of hour's of actual brightness at an annual rate of about (8.3) hour's, which contributed to an increase in the rates of normal temperatures at an annual
rate. It was about (20.8) °C, with an annual average minimum temperature of (12.8) °C. The station recorded an increase in the annual average maximum temperature of (28.6) °C, which is a relatively high temperature that shows the continental character of the study area.

The station also recorded a relatively high annual wind speed of 3.3 m/s, and this contributes to stimulating the movement of wind erosion, especially in light of the lack of Vegetation cover. The decline of Vegetation cover, whether Planted or natural, as the amount Of rain was recorded during the study Period about (220.9) mm, and the amount of evaporation at an annual rate was about (257.8) mm, and the relative humidity was recorded (45) %, Table (1).

The climatic characteristics of Tel Abta station show a clear rise in the hour's of solar radiation, a rise in temperature rates, a relatively high wind speed, and a deficit in the climatic water balance as a result of the low amount of Precipitation, high rates of evaporation and low relative humidity, which is reflected in the increasing severity of environmental deterioration in the region [2].

Table 1. climatic elements of Tel Abta station for the Period 1993 - 2020

| Evaporation /mm | relative humidity % | rain/ mm | Average wind speed /m | Max temperature /°C | temperature min/m 0 | normal temperature /°C | solar radiation /actual | solar radiation /theoretical | month |
|----------------|---------------------|---------|----------------------|---------------------|---------------------|----------------------|-------------------------|---------------------------|-------|
| 53.8           | 89                  | 42.8    | 2.7                  | 13.7                | 1.9                 | 8.3                  | 5.4                     | 9.6                       | .1    |
| 61.6           | 71                  | 35      | 2.5                  | 16                  | 3.7                 | 9.5                  | 6.1                     | 10.53                     | .2    |
| 124.4          | 61                  | 34.3    | 3.0                  | 20.6                | 6.9                 | 13.2                 | 7.5                     | 11.82                     | .3    |
| 185            | 56                  | 29.4    | 3.6                  | 26.9                | 12.0                | 18.9                 | 7.2                     | 12.96                     | .4    |
| 342.9          | 37                  | 8       | 4.1                  | 33.9                | 16.6                | 26.2                 | 9.6                     | 13.96                     | .5    |
| 470.9          | 24                  | 0.2     | 4.2                  | 39.3                | 21.5                | 32.1                 | 11.8                    | 14.43                     | .6    |
| 560            | 23                  | 0.2     | 4.5                  | 43.5                | 24.1                | 34.9                 | 11.1                    | 14.19                     | .7    |
| 491.2          | 25                  | 0       | 4.4                  | 45                  | 23.8                | 34                   | 10.9                    | 13.32                     | .8    |
| 410            | 28                  | 0.5     | 3.9                  | 38                  | 19.1                | 28.8                 | 10.3                    | 12.21                     | .9    |
| 240.05         | 39                  | 11.9    | 3.1                  | 30.9                | 14.1                | 22.4                 | 7.9                     | 11.02                     | .10   |
| 100            | 57                  | 17.7    | 2.5                  | 21.6                | 6.7                 | 13.7                 | 6.1                     | 10.1                      | .11   |
| 53.9           | 43                  | 40.9    | 2.1                  | 16.2                | 3.4                 | 7.9                  | 5.7                     | 9.3                       | .12   |
| 257.8          | 45                  | 220.9   | 3.4                  | 28.6                | 12.8                | 20.8                 | 8.3                     | 12.0                      | AV    |

Note: Ministry of Transport and Communications/ General Authority for Meteorology and Seismic Monitoring, Climate Department, Baghdad, unpublished data for the Period (1993-2020)

Figure 1. Actual and theoretical radiation at Tell Abta station
Figure 2. average of temperature at Tell Abta station

Figure 3. total rainfall at Tell Abta station

Figure 4. average of wind speed at Tell Abta station
2.1.4 The Soil

The soil in the study area is divided into the following types:

2.1.4.1 Red brown soils

It has a deep thickness in the north of Tel Abtah, with an area of 581.85 km², and it constituted 11%. It is of medium thickness and shallow in the middle. It is found under the surface of aggregates of lime or gypsum. It is either coherent or fragile. The chemical weathering Processes and biological activities in it are low with the Presence of loess soil in it and these are not distinguished. The area is not only in its depth, but it is also rich in organic matter. The depth of the soil does not remain the same, but rather decreases as we descend south towards the Plains of the South Island, as its cover becomes thin and its texture becomes more coarse and mixed with Pieces of gravel and sand and limestone rocks. map. [3].
2.1.4.2. Gypsum desert lands
It is found in the southern parts of Nineveh Governorate, including the study area, where it extends over most of its area, amounting to 3238.74 km², accounting for 62%. These soils are characterized by the presence of gypsum formations on them clearly on the surface, and the salinity rate is high and is characterized by its flatness with some spurs, but its slope appears clear in the northern part in the eastern part of it. There are depressions in which the water resulting from torrential rains collects, forming shallow lakes that turn into salt basins after the water evaporates from them due to the summer heat. It is predominantly light gray in color and is characterized by low organic matter due to its poverty in natural plants, as the percentage of organic matter does not exceed 1%. It is the most vulnerable type of soil to deterioration due to its poor vegetation cover and its low density and decline after the droughts that the region is exposed to and where wind erosion factors are active [4].

2.1.4.3. Sandy desert swamp soils
They are low lands and filled with alluvial deposits in the rainy season in winter due to the accumulation of water in them and they are dry in summer and the wind-absorption deposits of sand gather in these depressions. Its area is 221.09 km², which constitutes 4% of the total soils of the study area [5].

2.2. The causes of land degradation in the Tel Abta sub-district
Before starting the issue of addressing land degradations and limiting it, we must give a clear and simple idea of desertification and the reasons for its occurrence. Accordingly, there are two main movements behind the occurrence of degradations. The first movement is natural (due to drought), while the second is human due to man, and between them there is complex desertification. The following is a presentation of the most important factors causing land degradations in the study area [6].
First, the natural factors:

1. Land levelness: The surface of the earth in areas where sand dunes are formed is flat for long distances and is almost devoid of heights. sandy; The area of Tel Abta is 5,188.86 km², and the Percentage of flat lands in it is about 41%.

2. The high amount of evaporation: the increase in temperature on the one hand and the decrease in the amount of relative humidity on the other led to a rise in the monthly evaporation factor, as it amounts to about 3,353 mm Per year, so the evaporation of higher soil becomes more Vulnerable to Vegetation cover.

3. The rise in temperatures: The large amount of sunshine and the corresponding lack of clouds and lack of relative humidity during the hot months for a long Period of the year worked to dry the soil and disintegrate its Particles, which facilitates the work of the wind. The above factors are a lack of humidity, an increase in temperature and a lack of clouds [7].

4. Lack and scarcity of Vegetation cover: The rise in temperature and evaporation accompanied by a decrease in the amount of annual rain did not help in the establishment and growth of a Vegetative cover that Protects the soil from wind erosion Processes, except for some short herbs that grow in seasons or during the Period of rain, but soon disappears with the interruption of rain or it disappears before that as a result of overgrazing, which usually Prevails without controls.

5. A Winds is very strong factor of sand and dust is a transport factor. Arab Parts in the Middle East are exposed to trade winds and monsoons, which are affected by different climatic Pressures in winter and summer. The wind speed in the study area ranges between 11 - 13 km / h.
Second, Human factors affecting land degradations:
The specialists confirmed that the expansion of the desert area, which is dominated by sand dunes, was Primarily caused by man. Therefore, the degraded areas were called the desert of man. About 50,000 People lived in the area, with few resources in the study area, in 2014. Then the Population now reached about 38 thousand People. 17 thousand People are concentrated in the center of the district [8].Perhaps the most important reasons that humans have done and helped to deteriorate are:

1. Cultivation in areas that are not guaranteed rain with loose and brittle soils
2. Random and unorganized cutting of trees to be used for heating, cooking and Other Purposes
3. overgrazing that Prevails without regulation. Where she grazes huge numbers of livestock, amounting to about 700 thousand head of sheep, 50 thousand head of goats, 5 thousand camels and 1500 cows, at the expense of a small land that does not have the ability to support numbers of livestock, as once these herds move, they lead In both cases, the soil became loose and an important source of feeding the sand dunes through the wind.
4. The Role of farmers in soil erosion through irregular Plowing and continuous cultivation that exhausts the capacity of the soil, which increases and disintegrates the soil and its ability to move with the winds forming in the desert and desertification.
5. Non-optimal investment of natural wealth resources and expansion of its activities, especially the economic ones, which led to the disappearance of large areas of forests due to excessive cutting of trees.
6. overgrazing in natural Pastures and erratic consumption of a large amount of water in the use of agricultural cycles that restore some of the irrigated agriculture and cultivation of the land without Paying attention to its fertility [9].

The land Production began to decline from one season to another due to the mentioned human activity. The expansion of Various human activities led to the expansion of the area of the desolate areas with low Productivity from the unit of land without the cultivation of water. This has led to the emergence of the Problem of the spread of salinity in those areas, as more than 25% Of the cultivated land in the world has become unsuitable for cultivation due to the increase in salinity [10].

![Picture 3. Land degradations in Tel Abta sub-district](image)

Table 2. Area and Percentages of degraded lands in Tel Abta sub-district for the year 2019

| Percentage % | Area / km² | degradations type       |
|--------------|------------|-------------------------|
| 2            | 103.7      | Underrated lands        |
| 7            | 363.8      | Slightly degraded lands |
| 51           | 2649.8     | Underrated lands        |
| 40           | 2071.5     | severely degraded lands |
| 51%          | 5188.8     | total                   |

* Based On data in this Paper and Arc-GIs V.10.7
3. Results and Discussion

3.1. Methods of reducing land degradations in the Tel Abta sub-district

3.1.1. Develop models and early warning systems

A general component of a drought management Plan is the Provision of timely and reliable information. This information, if used properly, can reduce the severity of the effects of dehydration. In the past, drought management Plans were implemented using old methods. However, there are more proactive approaches to risk management, including early warning systems, which allow for better forecasting, monitoring and adaptation of droughts.

Early warning systems are used to detect symbols of changes in weather and climate. These systems always include rainfall and other climatic Parameters with information on water such as groundwater levels and soil moisture in a comprehensive assessment of current or projected drought or water supply conditions. In general, early warning systems can include forecasts, trends and projections, and the development of scenarios in order to identify slow or fast emerging risks. For the purposes of early warning systems, risk can be defined as "the Potential for adverse environment, and weakened capacities as a result of interactions between natural or man-made hazards and fragile conditions). The term "risk" is defined as:

Risk = Threats x Affect.

The FAO-sponsored Global Information and early warning System on Food and Agriculture is an example of the development of an early warning system that works at the global level.

* From the researchers’ work based on the Land sat 7 satellite image captured for 2019 and the Arc-Gis V.10.7 Program

Map 4. areas Of land degradations in Tel Abta sub-district
A role for long-term ecological monitoring in early warning systems. Particularly with regard to assessment of baseline conditions and initial impact susceptibility. For example, a network of long-term ecological observatories has been established in order to improve the level of assessment and monitoring of desertification.

This network assesses both trends in ecosystems and the linkages between ecosystems and socioeconomic systems. In addition to ecological monitoring, Proxy indicators of risk and vulnerability can be applied to biodiversity. This includes established early warning systems (livestock early warning system) and information network knowledge system on livestock and water (drought early warning systems targeting warehouse management) [11].

3.2. Modeling Climate Change
The desert fringes, and tropical dry and wet lands of dry lands have been identified as being highly vulnerable to the negative impacts of climate change, and a proactive approach to land and water management that takes into account projected changes in rainfall patterns is an essential tool. In this regard, climate change models can be considered an important management tool for dry land biodiversity. Climate change models have limits, however. In many areas, limited models are not available or are inaccurate enough to reflect actual changes. It is very difficult to reduce the effectiveness of precipitation changes because these changes are often greatly influenced by local microclimatic and topographical models. In addition, there are a few models of climate change that have been added to the biological models of multiple stressor.

A number of other management options based on the conservation and sustainable use of biodiversity can reduce drought risks, and therefore should be considered in drought management planning and implementation. This includes integrated land and water management (the application of the ecosystem approach), conservation and management of key natural resources, traditional knowledge, innovations and practices, and the use of agricultural biodiversity [12].

3.3. Conservation and management of natural resources
 Protecting the biological diversity of wet and semi-arid lands is an important tool in combating land degradations and desertification. They can provide results opportunities for wetland communities and contribute to poverty eradication, although it is often necessary to support these opportunities with activities such as improving market access, providing payments for ecosystem services, and developing a taxonomy of the products collected. In addition, the conservation of locally adapted species of plants and animals can increase the resilience of the ecosystem in the face of drought. For example, droughts have been found to have a more and more significant impact on imported livestock species as compared to local varieties or closely related wild species (although this may not affect their productivity in the long run).

Maintaining vegetation cover to protect the soil from wind and water erosion is a major preventive measure against the loss of ecosystem services in periods of drought. Where restoration is necessary, it is important to protect the site from further strikes, collect seed stocks and stimulate natural regeneration processes when they occur, monitor weedy species, and then prepare a full restoration plan that sets out restoration goals within the framework of desired outcomes, available budget and views of relevant stakeholders. Accordingly, conservation and restoration efforts using native species can achieve more positive results in terms of drought management.

3.4. Inclusion of traditional knowledge, innovations and practices
An important component of drought management plans is to build resilience of agricultural and pastoral communities and resilience of landscapes. Indigenous peoples and local communities play an important role through effective dry land resource management, particularly water management, which is often based on local decision-making structures and conflict resolution mechanisms. Indigenous and local communities use seeds, crops and animal diversity as a buffer against extreme weather conditions including drought and climate
change. Along these lines, many local communities have a well-developed knowledge of plant and animal biodiversity that can support conservation and sustainable use efforts. Women are important holders of biodiversity knowledge relevant to drought management and are often responsible for managing water resources. As such, efforts to include women in decision-making processes can be an important component of drought management planning.

3.5. Improving the level of use of agricultural biodiversity

Another component of drought management is addressing food security. Accordingly, some countries are looking to enhance access to different types of drought-tolerant crops in drought-affected areas. This includes identifying the different groups that have lower water requirements and the different groups that have higher rates of salt resistance (as a solution to the increased salinity associated with irrigation and drought). However, to benefit from genetic resources, it is important to conserve wild species of common crops. This conservation process can take place either within sites by protecting areas where these wild species can be found, or outside sites by means of mechanisms such as seed banks. Current efforts such as the International Seed Vault in Svalbard and the Millennium Seed Banks Project for the Royal Botanic Gardens Kew are aimed at protecting important plant collections located outside the regions. Indeed, it is expected that by 2025, about 10 percent of the world's wild plant species will be stocked with seeds.

3.6. Apply the Precautionary approach

Given the uncertainty of how climate change and desertification interact with drought to affect the biodiversity of wet and semi-arid lands, the Precautionary approach can be applied to drought management techniques to reduce the potential for catastrophic impacts. Indeed, proactive risk-related approaches to drought management have proven effective in reducing drought-related physical or economic losses, particularly in the face of climate change and vulnerability. These approaches, when most effective, include risk and impact assessment and impact management strategies.

In particular, given the consideration of an early warning threshold, the application of the Precautionary approach may involve lowering the threshold and establishing a feedback loop to monitor actual effects or conditions. In the case of water management, the application of the Precautionary approach may include limiting the withdrawal of funds at the level of levels to allow provision of reserves in the event of reduced flows, including by establishing minimum requirements for flows in order to maintain healthy coastal ecosystems. Whatever the case, and in any case where the Precautionary approach is applied, the adaptive management system should be adopted to ensure that the transition from one level of warning or intervention to another is taking place in a timely manner.

4. Conclusion

- Degraded lands cover an area of 48% of the study area.
- Soil types have a significant role in the deterioration and are represented by desert soils, which cover 66% and are more vulnerable to deterioration.
- The scope of agriculture is located in marginal marginal areas that are not guaranteed rain, including the study area, and because of the plowing of the land, which makes it disjointed and more vulnerable to deterioration.
- The surface of the earth for the study area is characterized by being one of the areas where sand dunes are formed on a flat surface for long distances and almost devoid of heights.
- The climatic characteristics of Tel Abta station show an increase in the number of hours of solar radiation, a rise in temperature rates, a relatively high wind speed, and a deficit in the climatic water balance as a result of the low amount of precipitation, high rates of evaporation and low relative humidity, which is reflected in the increase in the severity of environmental deterioration in the region.
The study area recorded an increase in the number of hour's of solar brightness, which reached an annual average of (12) hour's during the study Period from (1993 - 2020) and an increase in the number of hour's of actual brightness at an annual rate Of about (8.3) hour's, which contributed to the rise in normal temperatures rates.

- Lack of Public awareness among the residents of the study area to Preserve the environment and the land from deterioration
- overgrazing Plays an important role in eliminating Vegetation cover and exhausting soils, which increases land degradations in the study area.
- Lack of interest in the systems and methods of reducing land degradations in Tel Abta district and Nineveh Governorate in general, which caused a significant increase in land degradations.

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