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RESEARCH ARTICLE

DIMENSIONS OF DESERTIFICATION ON SUSTAINABLE DEVELOPMENT IN IRAQ.

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Abstract

Desertification is a major economic, social, and environment problem, desert is among the fragile ecosystem. The cause of desertification both natural and techno-genic (human) activiies.Drouthg, low rainfall, increasing temperature and climate change contribute to the drying out of already arid lands, but these areas also extremely to human activity 10-20% of dry land are already severely degraded and some report trace 70% of soil to human-induced reasons particularly population growth, agricultural technologies, and unsustainable policies. This loss of biodiversity as well as other negative outcomes that affect us all. As a result of human activities and decisions such as overgrazing, the relationship between seven key ecological factors-vegetation, temperature, precipitation, soil moisture, wind erosion and water erosion-become unbalanced. These mutually reinforcing relationships are especially susceptible to instabilities due to feedback effects, and perturbation like unsustainable cultivation practices are only magnified over time, resulting in essentially irreversible effects. The main causes of desertification in Iraq unsustainable agricultural practices through soil and crop management processes. Desertification also decrease in biological productivity of dry land areas which comprise in Iraq 92% of the total surface area, the summer temperature arrive to $52c^{o}$, increased evaporation 2000-3000 mm, number of sunny days 260 day, lower of cover rainfall 50-150 yearly where the number of rainy days in the north part 70 day and in the south part 40 day, the type of wind northwest raise dust.Iraq is considered as one of the region's most vulnerable countries to climate changes, and it faces a unique set of environmental degradation and increasing frequency and intensity of extreme weather events, especially sand and dust storms (SDS). This takes an enormous toll on eco-socio—economic life and human development in the region. Iraq is affected by the southern and southeasterly wind, which is a dry wind with occasional gusts of 80 Km/hr, occurs from April to early June and again from late September through November. This wind brings with it violent dust storms that may rise to heights of several thousand meters. From mid-June to mid-September, the "Shiamli" wind blows from the north and northwest. The very dry air permits intensive heating and aggravates desertification. It is particularly these two winds, which generate severe SDS in Iraq.Finally, added the

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military actions a significant burden of deterioration to the land of Iraq, where affected of; environmentally, economically and socially. The negative effects of desertification reached 92% of the land of Iraq, which affected negatively on biological production of land by amount 70%, lowest vegetation cover caused where migratedfarmers, increased dust storms,Iraq recorded 122 dust storms and 283 dusty days , and sources suggest that within the next ten years Iraq could witness 300 dusty days and dust storms per year, in addition toincreased soil salinity and decreased level of groundwater.

Introduction:-

Iraq is located in southwest Asia, one of the Middle East countries constitute the northeastern part of the Arab nation extends between latitudes (29^0 5^-, 37^0 22^-) north and between longitudes (48^0 45^-, 38^0 45^-) east. Iraqi area occupies 44 million Hectare from this suitable for agriculture 10,5 million hec.Available 8% to provide 30% of agricultural production and the desertified areaof 17 million Hec.Formed 92% of the total land where 15 governorates suffers from total the 18. Desertification mean land degradation in arid, semi-arid and dry sub-humid areas resulting from climatic variation and human activities [1].Sandy desertification is one of the most seriousecological problems in Iraq. Desertification in Iraq was especially in the middle and southern part, which estimated about one million hec.It harms the environment and damages all aspects of life [2]. It has become one of the most important problems from which many countries around the world suffer this has prompted the international community to draw to its hazards and to combat them through various international, regional and national organizations, since it constitute as environmental,economic,social and health challenge.Desertification mean degradation in arid , semi-arid and dry sub-humid areas which resulting from ecological variation and human activities ,sandy desertification is one of the most serious ecological problem in Iraq [3,4].Desertification in Iraq was especially in the middle , southern and western north part[5].It has become one of the most important problems from which may countries around the world suffer this has prompted the international community to draw to its hazards and to combat them through various international, regional and national organizations,. Iraq to day faces this serious hazard. Statistics reveal that 25000 hec.lost in Iraq annually from its arable lands as a result of desertification. This produced by natural and human factors. The area of arable lands in Iraq is estimated at around11.12 million hec.This constitute about 26%of the total area of Iraq, which amount to 43.5 million hec. Of which 5.45 million hec. at best are exploited in agriculture [6].The lowest of agricultural lands is due to salinization and desertification which were unproduction areas, surpassed 92%of the total land of Iraq [7].Also the demographic growth puts further strain on natural resources that are themselves ever more scarce, the Governments capacity to device and implement the necessary adaptation and mitigation polices is undermined by a daunting context of post conflict reconstruction. Further to common criteria of vegetation cover or over grazing of morelands, lack of erosion control, pollution has been addedbeside the above criteria. In addition to the negative effects of military operations on Iraqi biosphere (soil, water, air) from1981 and during 1991 to 2003 the southern Iraq suffered from very largemilitary actions [8].Thousands of heavy trucks and crawling vehicles; of different types and size that attain more than 30 tons, have crossed the Iraqi southerly parts. Beside the explosion of enormous of bombs and rockets have destroyed the compacted top soil layer in large areas causing emission of dust and facilitating in development of dust sand storm [9].Dust storm causes soil loss from the dry land ,and worse they preferentiallyremove organic matter and nutrient-rich lightest particles which consider fertile soil layer, thereby reducing agricultural productivity [10,11]. Other harmful that may impact the economy are;reduced visibility affecting aircraft and road transportation, reduced sunlight reaching the surface, increased cloud formation, increasing the heat effect, its harms to human health of breathing dust, lose fertile of soils and desertification was a major reason for vegetation cover demise[12].

Problem view:-

Desertification phenomenon is demolition and destruction the biological energy for soil, includes; soil fertility loss, demiseof vegetation cover, biodiversityabsence and in finally disruption the reaction status between organisms and soil by the reason of its unproductivity. Iraq face the major ecological problem represented as desertification whereContribute their events the natural and human factors, it has negatively results on sustainable development; ecological, social and economic which are loss productivity land and movement the sandy dunes then blowing the sandy or soil storms. Estimated the influenced lands by desertification 92% from the total areas of Iraq. Since 1981, desertification increased in large form by the reason of military actions which; destroyed each soils and vegetation

cover, where increased the soil salinity, forest feedback from 1.8% to 1.1%The removed area 12 km annually formed 0.5% yearly, feedback of palms from 30 million to 9.5 by the reason of wars, which caused; forest and vegetation degradation, drought, sandy storms increased and ecological deterioration. This effect on sustainable development and food safety.

Materials and Methods:-

To study any problem, especially environmental problems such as desertification will must resort to scientific methods to determine the size of the problem and following the scientific research , technical and advanced means, which is characterized by accuracy and speed where used in this research the spatial analysis for desertification phenomenon in Iraq by depending: on Aerial maps data , information of remote sensing and geo-ecology survey by using Space Information Systems of two agencies (NASA)),(NOAA),environmental monitoring data, General Authority for meteorological and seismic monitoring systems and field survey systems. Among the factors that were used to assess state of desertification in this study ,the spatial analysis was the method to measure the spatial relationship between natural phenomena such as desertification, so as to ensure the scientific explanation of the relationship between spatial and changing factors for the benefit in the analysis and evaluation, through understanding the causes of presence the biosphere and its natural balance , distribution of geo-ecology for natural factors on the earth surface in order to ensure sustainable life development of all living organisms interacting with each other in the ecosystem, predict the behavior of natural phenomena such as desertification and the use of spectroscopy detection technique based on the process (Pixel) wise, and their dimension on the level of environmental-social –ecological-ecnomic,can say spatial analysis that identify the patterns of spatial changing characteristics to this phenomenon and properties. It gives a clear form to desertification problem, which affects the land and associated factors that affect the stability of various human activities. Among the most important of adopted indicators in variables lands degradation were; vegetation cover, green belts, climate, topography, , water surfaces, valleys, artificial pastures, nature pastures, geomorphological, geological features, natural resources (air, water and soil), soil characteristics, climate location of the land (dry, semi dry, wet),land use method, these investigation in the study, and special information on the general authority for meteorological and seismic monitoring and scientific interpretation of to the case of interaction between the variable of environmental factors and their involvement with human impact factors of the worsening desertification in Iraq.

Discussion and Results:-

One of the main reasons behind the development of desertification is the climatic changes in Iraqi regions, especially the drastic decrease in the annual rate of rain fall, besides environmental changes, such as drying of the marshes, land degradation, and desertificationsince the last decade, the annual rain fall has drastically decreased causing drought. The annual rainfall, annual precipitation and annual sand or dust storms(SDS) in different parts of Iraq is mentioned in Table(1), whereas the annual rainfall throughout the year 2012 was between (100 - 200) mmin the southern lower part and (200 - 400) mm; in the northern upper part of Iraq.Iraq experiences its wet season from winter through early spring, with hot, dry summers. Temperatures frequently exceed 45˚C during late spring and summer afternoons, and will often remain above 37˚C overnight during the summer. Dew points and humidifies are usually quite low, where moisture content of the air is greater, and summer heat indices can be extremely high. These extreme changes in the climatic parameters, especially rain fall, which will be decreased by 25% and water flow will be reduced by (20% - 30%)also height of temperature, Figures (1, 2) [13], as compared to those which were prevailing during the last century, had contributed in the increasing events of SDS, besides increasing the dust potential in different parts of Iraq,Figure (3).Usually, the fronts of dust storms are accompanied with strong wind, and occasionally rain drops, which may last for few minutes. The height of the front never exceeds 25 m, usually ranges between (10 – 15m), Figure(2),) [14], and it has two sharp lateral boundaries, Figure (3), this is attributed to the difference in the pressure. In dusts, however, neither front nor sharp lateral boundaries exist. Moreover, the height of the sand (dust) is much higher than the dust storm, and the settling time in the former is much longer than the latter. This is attributed to the strong wind (up to 120 Km/hr.). Iraq recorded 122 dust storms and 283 dusty days, that accompanies the latter, which blows the sand and/or the dust far away to be settled ,Figure(4).Since the storms blowing from the west have been suggested cultivate the green belt from north to south by many lines for impede storms which called green nationalbelts, Figure(5). Technically speaking there are subtle, yet distinct differences between dust and sand storms [15]. The main differences between them are mentioned as following Where the upper limit of the range the amount of dust falling in 2006; in Anbar province 9 (g / m² / month) ,in Basraprovince 168 (g / m² / month),in Salahuddin province 1.2(g /m²/month) and 60 (g/m²/month)inMissanprovince . In the provinces of Iraq we observe land desert and desertified areas as; in Babylon province found in the area of the

(Aljazeera)(Shomali / Midhtah) ,in Salahuddin province in (Tikrit and Baiji), in Qadisiyah province in (Afak),in Anbar province most of the territory of the province is desert, under decaying vegetation due to lack of rainfall and overgrazing and logging and formation some sand dunes, in Dhiqar province in southern (Batha) center of Nasiriyah to Basra, and in Basra province, vegetation deterioration due to overgrazing and logging, and are some of the sand dunes, this applies to Wasit pronince, also at Nineveh province in (Alhadder) ,(Alsakhnah) and (Abu-Adil),in Karbala province, more desertified landsin (Alkrt),(Ain-Altamir), and in (Razzazah) by area estimated at 26 square kilometers,in Muthanna province 700 hec.Desertified lands especially in the district of (Alkhedir), a desert area exposed to soil erosion and to be fixed and moving sand because of the lack of green belts [16]. It is here shown that desertification hit wide areas was one of the best agricultural land.Salinization is the main factor to desertification, which amounted to a very serious degree. In fact, the spread of salts in the plain of Mesopotamia, was found after cultivation through successive generations, where historical sources indicate that the history of irrigation of agricultural land in this plain, due to the more than six thousand years. Hence the view that, if the transmission centers of ancient civilizations from the south to the center and the north was caused by the spread of salts in the soil and declining production. It is clear that the spread of the salts is due to factors Geomorphology, hydrological and climatic and characteristics of soil and water, and the human factor of non-use of irrigation techniques appropriate and that means the absence of novel irrigation techniques and scientific methodsin agriculture. The agricultural land which lost annually as a result of erosion and salinization, soil degradation, significant compared to the total area of land cultivated with an area of agricultural land in Iraq's 10.5 million hec., but the ones available for the cultivation of up to 3.5 million hec., including 1.5 million hec. In the rain-fed area, which fluctuates depending on the amount of rainfall producedtherefore, agricultural production contributes to food security by not more than 30% on average of various agricultural commodities [17]. This is one of the biggest indicators of food security deficit and thus the adoption of Iraq's growing import and leaves of a negative impact on the economic system. In Nineveh province in 4 regions, this is clearly evident from the survey and spatial analysis, which caused themigration (displacement), harmed (30000) human, in Baaj (134) village and (70) of the village population in others, where the human total migration were (392.400) human as Table (2). The destruction of 75% of the livestock in addition to loss of biodiversity and degradation of soil and vegetationcover [18].In study of land degradation in Iraq clear in thethesis deals with the solvent of the urgent problem in the field of the environmental safety – the evaluation of the changes in the state of natural complexes as a result of military operations and the development of measures to restore degraded soil and to improve water resources of the country. To study the peculiarities of themilitary operations impact on the natural complexes, the field studies and the observations of 30 pilot sites, which differ in geologic, geomorphologic and soil-vegetative relations, were carried out. Thus, depending on the degree of the military impact, non-degraded, slightly degraded, degraded, highly degraded and extremely degraded areas were identified. Taking into account the degree of the degradation, the sketch map was created, which shows the spatial differentiation of the territory according to the degree of degradation. The research of soils in areas of military operations was held by putting of pair sections on degraded areas and on slopes of defense lines, trenches and bomb craters. Research of physical properties of soils showed substantial change of density throughout the height of sections, agitation of soil horizons, presence of particulate matters – debris, cases and garbage on degraded areas. In degraded areas quantity of humus has decreased greatly, values of pH have increased and non-uniform content of moving forms of potassium (K) and phosphorus (P) is observed. Erosion processes hold more intensively on degraded areas. Alldata wererepresented whereshowed degradation of soil cover in areas of military operations. Mining of large areas caused expulsion from rotation of agricultural lands, decrease in the recreation importance of landscapes, soil degrading, fishes and animal'smortality.Degradation of soils leads to water-bearing horizons decline, pollution of ground waters, occurring because of treatment facilities destruction. Researches showed sufficient operating efficiency of treatment facilities and tertiary treatment stations of drinking water. Pollution of water supply surface sources is observed because of absence of enough number of treatment facilities. Research of underground water quality showed unfitness of water for drinkingbecauseofitssalinity .To analyze the spatial degrading of natural landscapes used a density of degraded sites per unit area and counted the proportion of types of degradationareas by the following equation:

$$eP=\frac{\sum fi}{F}$$

Where P - an indicator of degraded areas; f - single objects in a given set of (funnel, shelters and others.); The F - land area. If this were isolated, non-degraded (<1%), weak degraded (1-5%), degraded (5-25%), significantlydegraded (25-50%) and excessive degraded (> 50 %) of the territory. Taking into account the degree of violation of natural complexes within Iraq and a set of factors identified Mapping diagram reflecting spatial

differentiation of areas on the degree of impairment ,Fig(6)[19]. In general, possible summarize the impact of desertification as inFigure [7].

Table 1:- indicate climate change in 18 province for duration 40 year.

Governorate	Mean annual rainfall (mm)	Mean annual temperature (˚C)	Mean annual dust storms (days)	Dryness index
Baghdad	150 - 200	23	12	20 - 25
Mosul	300 - 600	18 - 20	1 - 4	5 - 10
Basra	75 - 150	24	8 - 24	15 - 20
Erbil	400 - > 800	< 16 - 19	1 - 4	< 5
Suliamaniyah	500 - > 800	< 16 - 18	1 - 2	< 5
Dohuk	600 - > 800	18	1	< 5
Kirkuk	200 - 400	20 - 22	2 - 4	5 - 10
Salah Al-Deen	100 - 300	22 - 23	4 - 12	10 - 20
Diyala	150 - 450	23	4 - 12	15 - 20
Anbar	< 75 - 150	18 - 22	4 - 8	20 - 35
Wasit	150 - 200	23	2 - 6	20 - 25
Misan	150 - 200	23	2 - 8	15 - 25
Babil	100 - 150	23	10 - 12	25 - 30
Karbala	75 - 100	22 - 24	8 - 12	30 - 35
Najaf	75 - 100	22 - 24	8 - 12	30 - 35
DhiQar	100 - 150	24	6 - 12	20 - 30
Qadisiyah	100 - 150	23 - 24	6 - 24	25 - 30
Al-Muthan'na	< 75 - 100	24	12 - 24	25 - 35

*Climatic Atlas of Iraq (1951-1990).

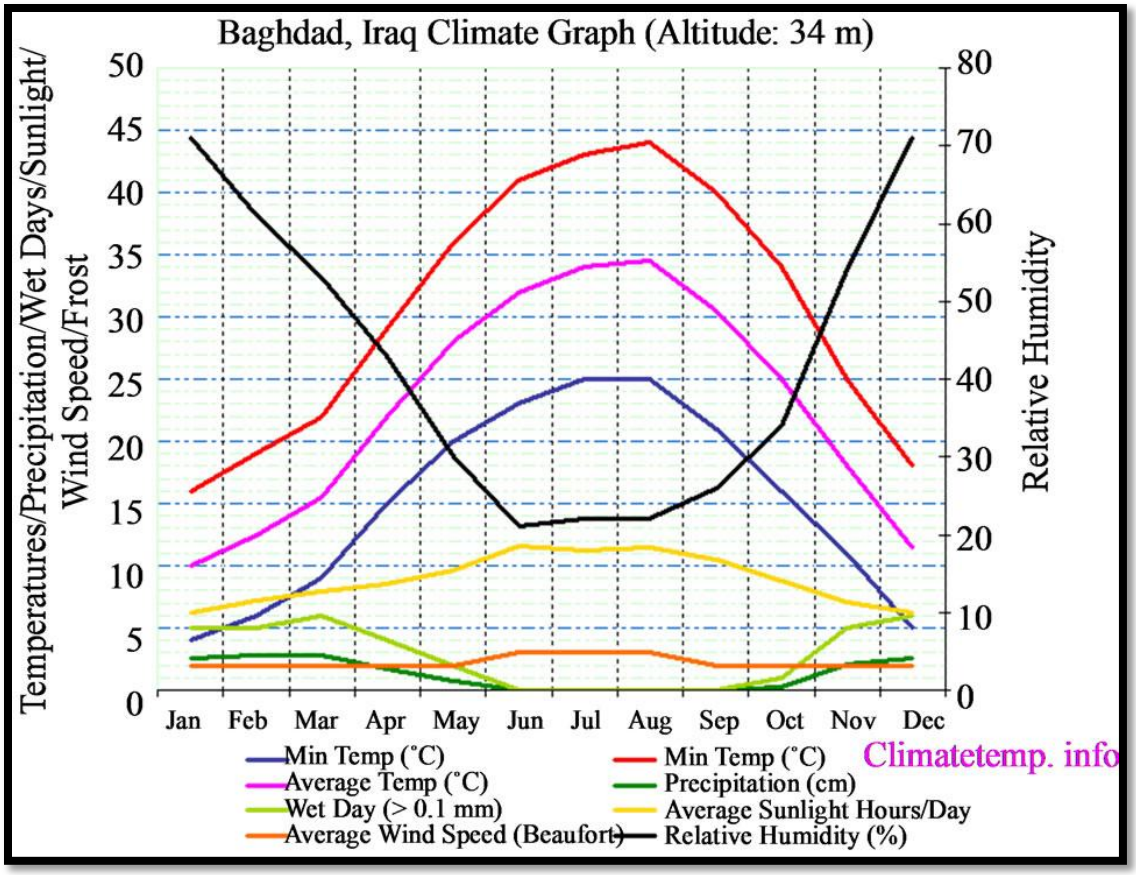

Figure 1:- Climatic parameters in Baghdad, 2009

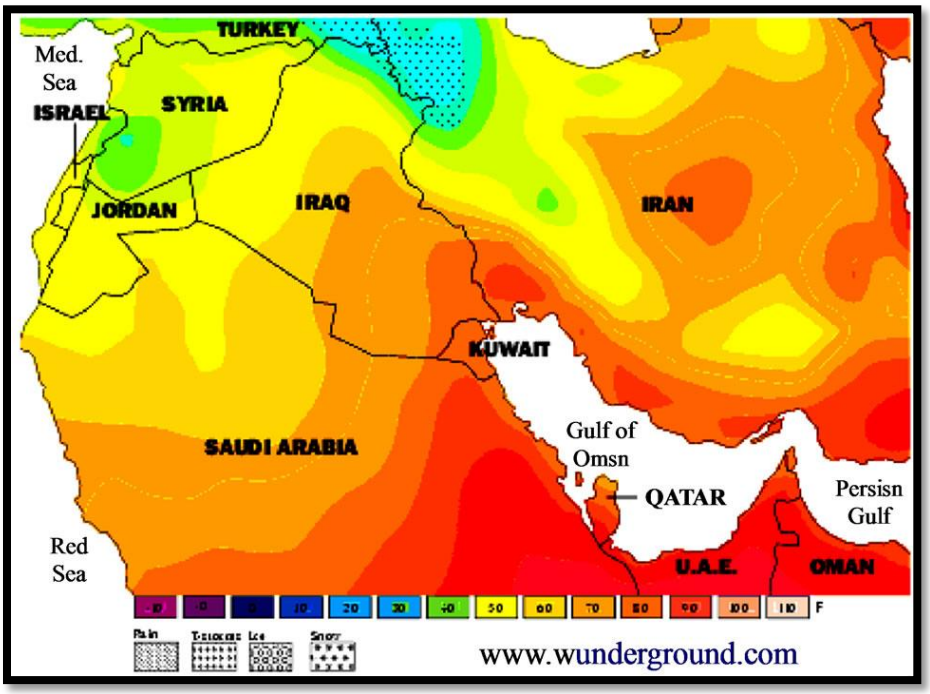

Figure 2:- Temperature map of Iraq and surroundings, October, 2009-2013

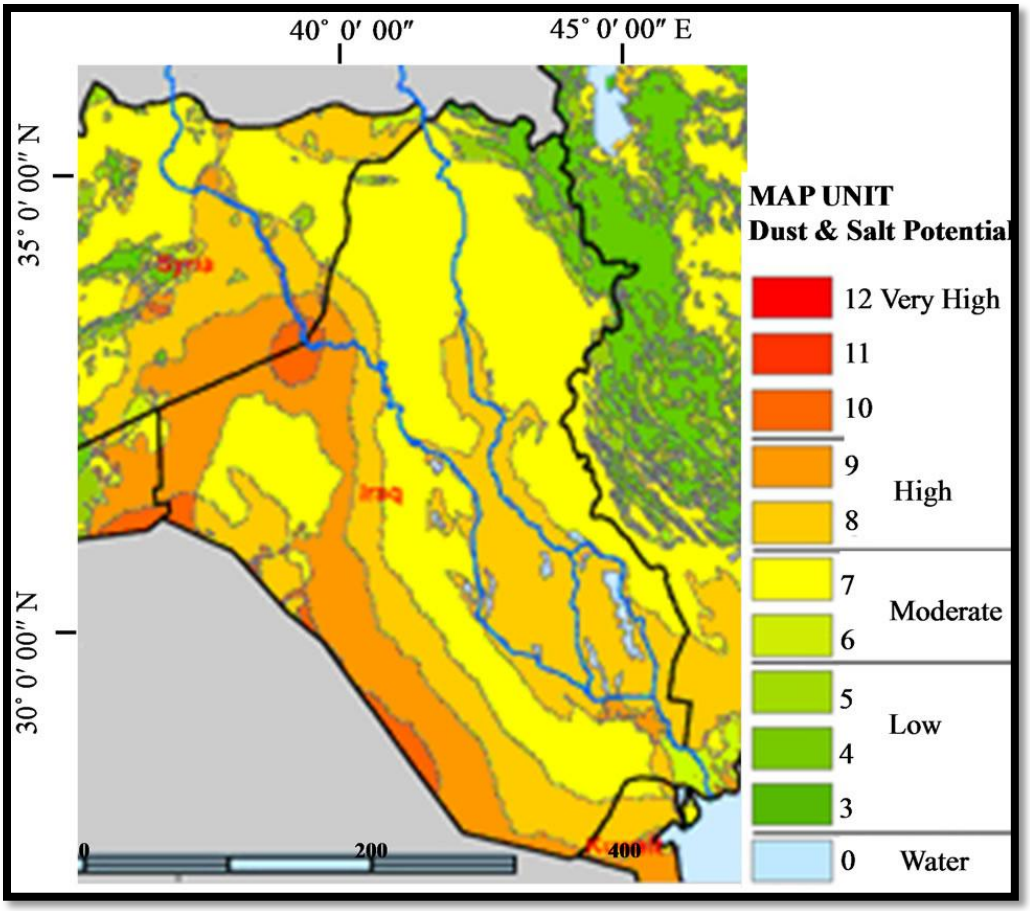

Figure 3:- Map explain dust and salt potential in the all areas of Iraq.

Figure 4:- Explain soil storm in the south part of Iraq.

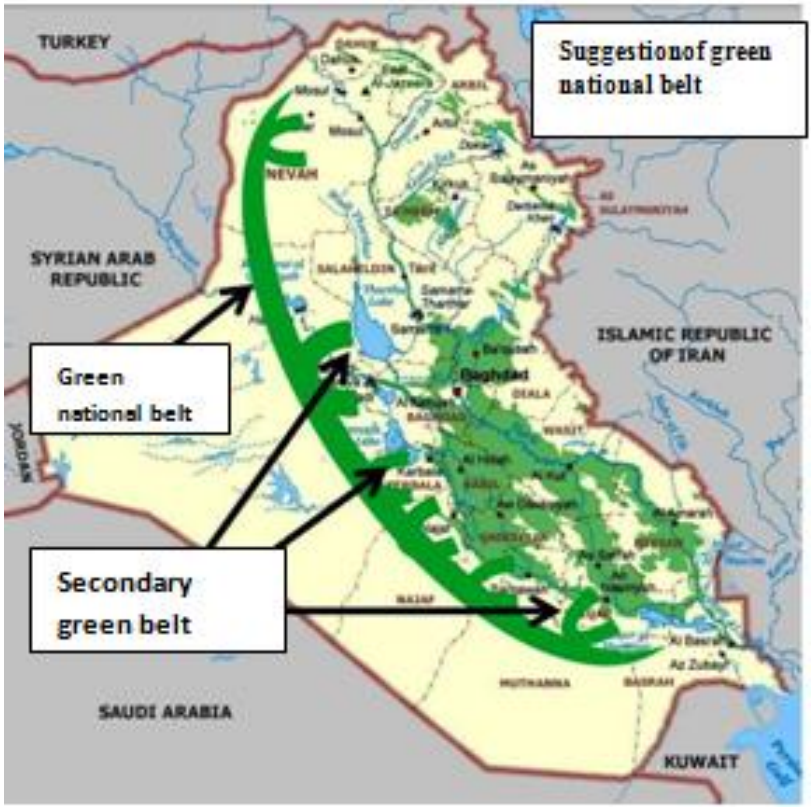

Figure 5:- Suggestion of green national belt.

Table 2:- Indicate to spatial and population statistic in 4 deteriorated region in Nineveh province.

Degraded regions (Nineveh province)	Areas degraded by desertification in Dunum=50mx50m	Threatened population
Baaj	539.160	165000
Alhadder	266.342	30000
Telaptta	432.980	47400
North region	147.361	150000
Total	1.385.843	392400

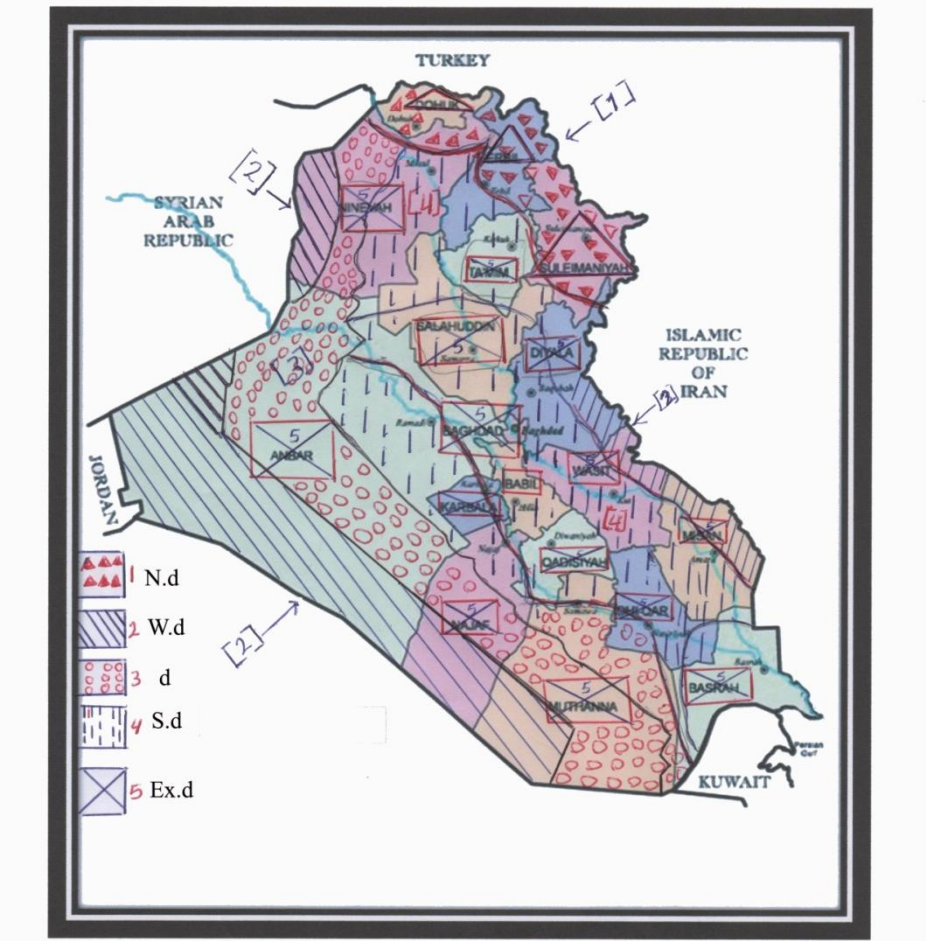

Figure 6:- Shows degraded proportion of land by reason of military action.

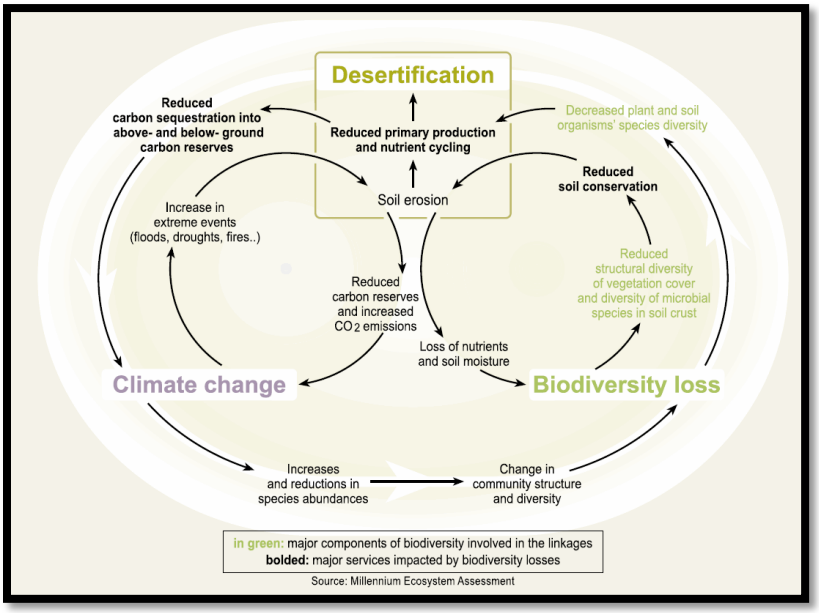

Figure 7:- shows the impact of desertification on sustainable development.

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