

Comparative Analysis for Dust and Sand Storms In Iraq: A Survey

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Abstract The research delves into Iraq's escalating sand and dust storms, primarily linked to dwindling vegetation and desertification. Its focus lies in understanding, analyzing, and offering solutions for these environmental occurrences. Notably, it emphasizes the efficacy of programs increasing vegetation and controlling desertification in reducing storm frequency. Utilizing a comparative analysis drawn from diverse data sources, the paper scrutinizes the causes, impacts (ranging from environmental to economic and health effects), and proposes various strategies. These include implementing enhanced monitoring systems, effective land-use management, and promoting public awareness campaigns. Ultimately, the paper stands as a vital resource for policymakers, researchers, and practitioners seeking to grapple with the challenges posed by these storms in Iraq. Its comprehensive insights serve to aid in decision-making and formulation of strategies to mitigate the detrimental effects of sand and dust storms in the region.



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Keywords: Iraq; Sand storms; disaster management; Desertification.

1. INTRODUCTION

The number of natural disasters affecting the world has been increased in the last years, and because of climate change the frequency of the occurrence of natural disasters related to weather is expected to be increased. From the period between 1980 to 2004, approximately two million people were killed, and an estimated five billion people were affected and a trillion of US Dollars damage was caused by natural disasters. And while countries all over the world are affected by disasters, developing countries have been impacted more by it than developed countries that are more prepared to handle the disaster.[1] Iraq is one of the most effected countries in term of impact on GDP by sandstorms while its population is at high risk of sand storms.[2]. This paper will discuss the difference in disaster management between developed and developing countries using the sandstorms that affect Iraq as a case study.

2. LITERATURE REVIEW

- a) [Climate Change: Consequences on Iraq's Environment]: this paper discuss the effects of climate on Iraq and it effects including the increase in sandstorm rates[3].
- b) [Drought severity and increased dust storm frequency in the Middle East: a case study from the Tigris–Euphrates

alluvial plain, central Iraq]: This is a study of the relationship of local climate and its effect on the formation of dust storms in central region of Iraq[4].

- c) [Sand and Dust Storms in the Middle East and North Africa Region—Sources, Costs, and Solutions. Washington, DC].: this is a comprehensive report about sand storms in MENA region, their sources, causes and effects and as well as the possible actions that can be used to prevent the occurrences of Sand and Dust Storms[5].
- d) [Sandstorm and its effect on particulate matter PM 2.5, carbon monoxide, nitrogen dioxide, ozone pollutants and SARS-CoV-2 cases and deaths]: this paper discusses the negative effects of sand storms on air quality and its effects on pollutants and pathogens[6].
- e) [Topology Analysis of Wireless Sensor Networks for Sandstorm Monitoring]: this study analysis advancement in simulation and modeling of sand storms and its effects on risk management.[7]

3. SAND STORMS IN IRAQ

Iraq is a country that is very vulnerable to the effects of climate change, and it is a country that faces an increasing degradation in the environment and an increase in the intensity of weather events especially sand storms .Sand storms present a danger to public health. The diameter of the particles of sand and dust is a determining factor on of its effect on human health. Particles sized 10 micrometers and larger are not breathable, thus they are only capable of causing exterior organ damage such as irritations to the eye and skin. small particles sized 10 um or less can be can enter the respiratory tract, and can cause damage to the respiratory

tract and cause disorders such as asthma and pneumonia and more[8]. The formation and occurrences of sand and dust storms in Iraq and its surrounding region are widespread, sand and dust storms are more widespread throughout summer and spring seasons due to the increase in strong winds during that time [9]. one of the recent sand storm incidents that affected Iraq happened in April 2022, the incident was captured by NASA Suomi NPP and Terra satellites, as shown in figure (1) and (2). this dust storm covered north and south of Iraq reports of dozens of people have been hospitalized due to the sand storms effect.[10]

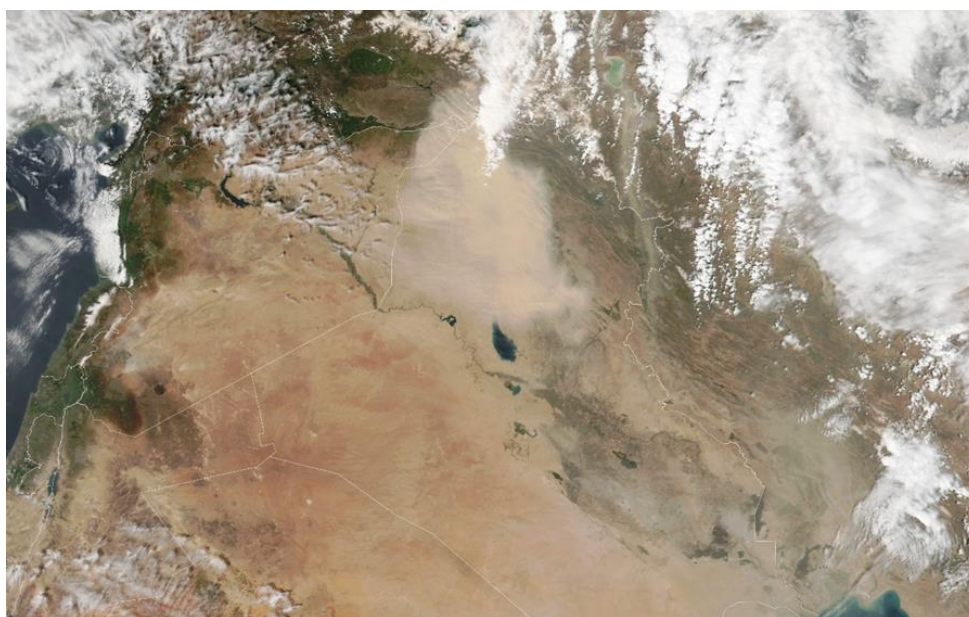


Figure1. image of dust storm effecting Iraq taken April 7, 2022. [10]

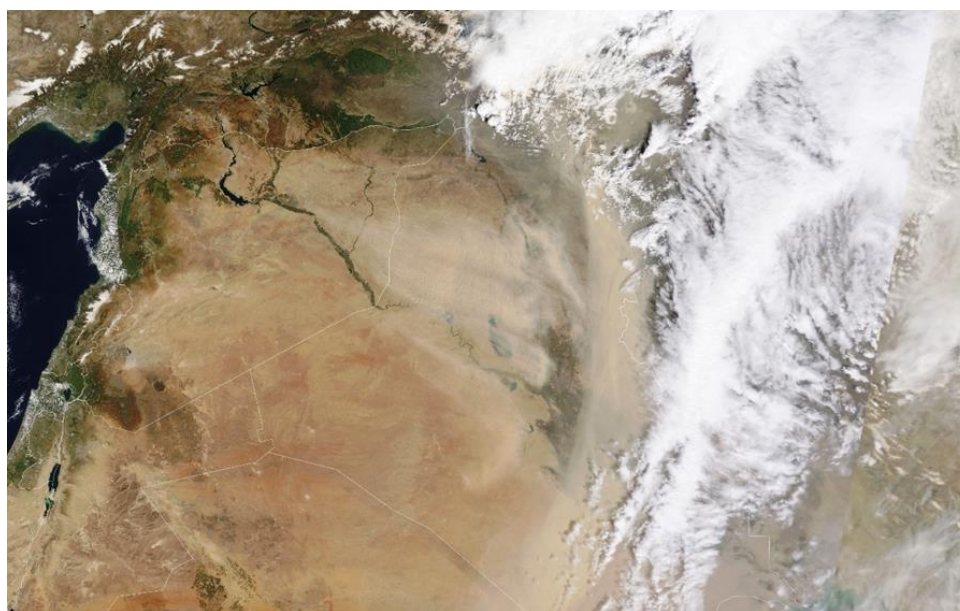


Figure 2. Image of dust storm effecting Iraq taken April 9, 2022. [10]

In the past decades, the amount of annual rainfall has drastically diminished which caused Drought; not only

limited to Iraq but in all neighboring regions.[9] research showed that arid areas in Iraq covered approximately 73% of the total land area according to data recorded in the



1980's, this figure increased to 78% in 1990's and to 88% in the first decade of 2000 [11].

Due to this reduction in rainfall quantity, the surface has suffered from loss in the amount of vegetation. this loss of vegetation contributed to loosening of the top layer of soil, which caused an increase in the number of moveable particles. And strong winds passing on the area would carry these particles; which contributes to the rise in rate of sand and dust storm occurrences. Another contributing factor to sand storms in Iraq is the increase of water damming in neighboring countries, which causes a reduction of water flow rate from the Tigris and Euphrates rivers, which led to loss in the amount of water available for agriculture and in turn causes loss of agricultural land and an increase in desertification and of arid lands. In addition, the drying the loss of the Iraqi marshes and the inability to restore them is another element adding to the increased number of sand storm occurrences. Therefore, these factors and more are what causes Iraq to be a Very High Potential area for dust and sand storms .[9]

4. SAND STORM ANALYSIS METHODOLOGY:

Sand storms are a persistent and growing issue in Iraq, so it's of important to identify ways of predicting, preventing and

Table 1: methodology and results summary for the previous related works

Ref. No.	Methodology	Results summary
[1]	Estimated prediction	According to reports provided by the UN, the Iraqi Ministry of Environment logged 122 sand storms and 283 days effected by dust in 2012 and it is estimated the number of dusty days could increase up to 300 in the coming decade
[2]	Standardized Precipitation Index (SPI) analysis	After analyzing the data of the standard indicator (SPI) of precipitation over the past 36 years, it turns out that the number of years of drought was much higher in the governorates such as Diwaniyah and Nasiriyah compared to Baghdad. However, this drought was moderate, and cases of severe drought and extreme wetness are rare (0–6%)
[3]	Ground survey	The amount of land that is susceptible to erosion Worldwide is approximately 32 million km ² , 17 million km ² having been graded as a high or very high susceptibility rating. The erosion of soil matter as well as the increase in aridity and desertification that causes a decrease in vegetation is the main culprit in causing sand storms.
[4]	Statistical analysis	The sand storm event caused a significant increase in the quantity of pollutants in the air including PM 2.5, CO, and O ₃ , which are related to the increase of SARS-COV-2 cases. Though, no substantial change was recorded in NO ₂ and the quantity of fatalities after the sand storm.
[5]	Topological analysis using geometric graph modeling	A sandstorm management system can be used for sandstorm monitoring and warning; and can be used for the determination of a sand storm disaster; integrates multiple technologies; can be used to track sand storms in real time; is reliable, accurate and flexible; and can be used to monitor pollutants such as PM 10 and PM 2.5 dust density in the air.

minimizing the damage they cause. There are many ways to predict sand storms and of them is “Sand and Dust Storm Warning Advisory and Assessment System” also known as (SDS-WAS), this is warning system that delivers sand storms predictions through a network of researchers all over the world. SDS-WAS was developed by the world metrological organization (WMO) [12]. This system can be used to predict sandstorms to minimize the damage they cause. In the year 2000 China implemented sand storm control programs in located at its northern region to combat the increase of soil erosion and the spread of desertification. studies show that these programs have an impact on the environment and caused an increase in vegetation cover in the area and had caused a reduction in soil erosion in the area by about 62% compared from year 2001 to 2014[13]. Implementation of similar sand storm control programs in Iraq may yield a similar result in the decrease of soil erosion and therefore a reduction in the frequency of the formation and damage of sands storms that affect the country.

5. EXPERIMENTAL RESULTS:

several papers connected to the subject of sand storms were reviewed and were summarized. Experimental results from related works could be summarized in the following table 1:

6. CONCLUSION

Sand and dust storm is an important and growing problem in the MENA region and especially in Iraq. Sand storms are formed in desert regions and arid land susceptible to desertification and soil erosion and a decrease in rain fall and

river water flow has caused an acceleration in the desertification of the area. This research concludes that the combat of accelerated desertification, the increase in vegetation cover and the mineralization of soil erosion lessens the impact and frequency that effect Iraq.

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