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# Risk and Emergency Management System to Mitigate Disasters

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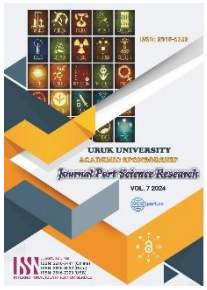
**Abstract** Disasters lead to many violent strikes in terms of material, human and humanitarian losses, and destruction of property and infrastructure of the state. The term "emergency management" refers to a diverse range of activities. The primary responsibility for disaster response rests with the government at all levels (Peiris P. S. H. 2020, Opadey. 2021). Disaster management is still limited in Iraq, as long as necessary are in place to warn of these disasters. Therefore, we will use in this prepare the Remote Sensing (RS) and Geographic Information System (GIS) to mitigate disasters effects and focus on sandstorm, landslides also study prediction and prepare the prediction and GIS earthquake of east of Iraq. The Risk management systems are useful and effective tools for disaster management in Iraq and by using database on expected disaster for future. The future is to forecast, reduce damage, and assess the severity of these disasters. This essay will list emergency management initiatives and explain how geographic information systems can be used (GIS) and Remote System (RS) technologies play a critically important role in mitigating disasters.



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**Keywords:** *sandstorm, earthquakes in Iraq Remote sensing, geographic information system*

## 1. INTRODUCTION

Sand and dust storms are natural disasters that are more common in dry and quasi climates These storms are primarily caused by a long history of ineffective and inefficient farming methods. Water asset management issues and local environments, particularly Climate change continues to contribute to drought, desertification, and shrinking vegetation cover. all of influence the geographic dust-storm situation's rise. The geographic event usually extends beyond Iraqi territory in various However, it typically crosses Iraqi land on its way to Kuwait, Saudi Arabia, and/or the Arabian Gulf, and less regularly reaches (Theilen Willige et al, Al-Umar M. H et al 2019). A thorough earthquake catalog for Iraq and surrounding regions was compiled as part of a larger stochastic seismographic evaluation framework. In 1976, The establishment of the Iraq Seismic Network (ISN). and went live in the early 1980s (Sissakian et al. 2015). The regional event, in general, extends beyond Iraq into Iran and Turkey. Geographic Information System (GIS) and remote sensing are incredibly efficient and essential disaster response tools management, which necessitates the implementation of a cycle, as shown in Figure 1. These technologies have piqued the interest of all countries and organizations involved with space and precise emergency services. The goals of disaster experts in disaster management are to continue monitoring and simulating the complex disaster incidence as accurately as possible. This is done to improve prediction models, identify appropriate emergency plans, and build spatial databases Remote sensing data can be used to fast assess the severity and effect of natural disasters such as earthquakes, sandstorms, fires, and floods.

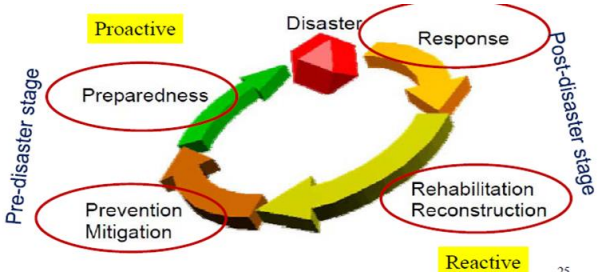


***Figure 1.*** *earthquakes, sandstorms Risk Management Cycle*



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***Table 1*** *explains the risk management cycle for the Earthquakes and Sandstorms.*

| | Disasters |
|---|---|
| Response | Earthquake, sandstorms |
| | Rescue operation; - First-aid care; - Secondary tragedy monitoring |
| Rehabilitation Reconstruction | Reconstruction that is disaster-resistant; - Appropriate land use planning |
| Prevention Mitigation | Seismic design forests to protect against storms-Retrofitting of Tower blocks that are vulnerable Systems for seismic isolation and result will be displayed |
| Preparedness | Building and fabrication meteorological, Observation systems earthquake observation system operation |

## 2. SAND STORMING IRAQ

There is a large amount of multi-temporal spatial information. required for natural sandstorm management. Satellite remote sensing images with a spatial resolution of 60 meters and four spectral bands were seen for the sensor Spectroscopic Scanner (MSS). The Thematic Mapper (TM) is a high-resolution hyper spectral scanning Earth resources sensor. The OLI (Operational Land Imager) is an ideal tool for sandstorm Because it offers details over large areas at short time intervals, it is useful in management; however, in practice, it is mostly used for caution and monitoring. Remote sensing has evolved into a useful tool in the military. sandstorm over the last few decades. Remote sensing data cannot be used unless it is combined with information derived from other sources, such as graphs or quantification stations, using a suitable tool. As a result of the expansion of remote sensing applications, GIS has become increasingly important for Information Systems (IS) and disaster management. monitoring and warning. As shown in Figures 2 and 3, Iraq is located in an area where sand and dust storms frequently occur and last for several days, coming from the north west (Syria), the middle west (Jordan), and the south west (Saudi Arabia). Sandstorms and sand are two of the most severe natural hazards that humans face. The primary causes of this storm are as follows: serious natural challenges that people face. The main causes of this storm are insufficient time to become wet, which results in the loss of green area due to a lack of sufficient rain and ineffective farming methods, as well as Iraqi areas located in dry and semi-dry areas. In recent years, there has been a significant increase in the severity and frequency of these. Iraq's Ministry of Environment recorded According to sources, there were 283 grimy days and 122 dust storms between 1980 and 2015. (See figure 4 and database figure 5). Each year, Iraq may experience 300 dusty days and storms. Strong winds frequently cause sandstorms and dust storms in Iraq and other Middle Eastern nations, especially in the spring and summer. winds from the northwest. Iraq has a low relative humidity (RH percent), ranging from 22.9 to 28.1 percent in the north, 23.8 to 28.6 percent in the center, and 20.6 to 25.3 percent in the south. To mitigate the effects of sandstorms, there are several factors to consider, including the use of remote sensors, the GIS database, and the information in Table 1 to identify and describe emergency management activities.

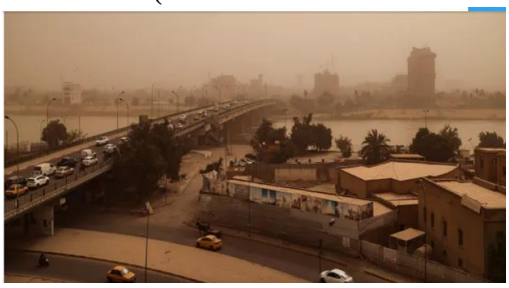

***Figure 2****. The sandstorm in west of Iraq*

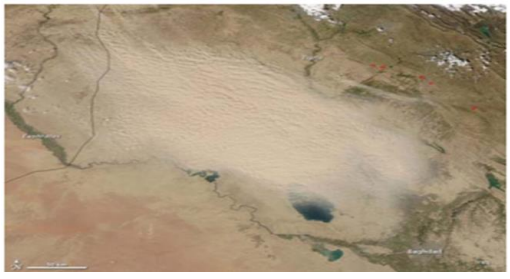

***Figure 3****. The sandstorm from west (Syria, Jordan and Saudi Arabia)*



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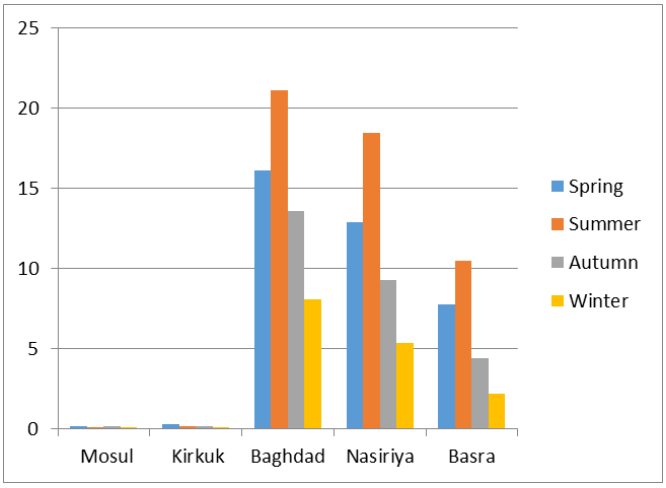


***Figure 4**. The graph of dust coasted from sandstorm*

Blue is in Spring, Red is in summer, Green is in Autumn, Purple is in Winter

| E | D | C | B | A | |
|---|---|---|---|---|---|
| Winter | Autumn | Summer | Spring | Av. Diust Ri | 1 |
| 0.1 | 0.2 | 0.1 | 0.2 | Mosul | 2 |
| 0.1 | 0.2 | 0.2 | 0.3 | Kirkuk | 3 |
| 8.1 | 13.6 | 21.1 | 16.1 | Baghdad | 4 |
| 5.4 | 9.3 | 18.5 | 12.9 | Nasiriya | 5 |
| 2.2 | 4.4 | 10.5 | 7.8 | Basra | 6 |

***Figure 5.** The Database of dust coasted from sandstorm*

A represents the average of Iraqi dust counters in the spring, C in the summer, D in the autumn, and E in the winter.

## 3. EARTHQUAKES IN IRAQ

Ground shake is most common in belts that coincide with tectonic plate boundaries (Peiris P. S. H. (2020). The quake has the potential to cause widespread destruction and loss of life. Natural disasters, such as earthquakes, can be predicted in advance to reduce risks and save lives. In fact, predicting when a tremor will occur is impossible (Opadeyi 2021). The spatial locations of seismic activity, on the other hand, can be predicted, and the vast majority of tremors have happened where they were expected to (Theilen Willige et al 2013). A future earthquake's location can be determined. with early evacuation planning. As a result, there are a plethora of scientists, experts, and systems. figure. regard forecasting and assessing earthquake spatial locations as important tasks (Hassan M. Ali 2013). The main parameters that can help researchers predict the Time periods, remote sensors, and a database of previous seismic data are used to forthcoming earthquake areas can be foreseen. The eastern portion of Iraq will be covered, especially the areas that are currently experiencing or had a lot of seismic activity in the past, as well as places where earthquakes have previously happened. There are numerous tectonic plates in this region. seismic events and margins due to forces of compression, tension, or shearing. The study area, which spans Longitudes 45°E and 42°E, is shown in Figure 7. and latitude 31°N to 34°N It is situated in the Mesoamerican zone, close to Iraq's and Iran's northeastern borders. The study area is subject to active seismic activity due to its location on active faults such the Makhul-Hemrin fault, the Euphrates fault, and the Badra-Amarah fault. The Arabian and Eurasian plates' tectonic plate boundaries are where it is located.

There are frequently earthquakes in this area. A statistical method is used to predict future earthquakes using remote sensors (RS) and Geographical Information Systems (GIS). GIS can be a useful tool for analyzing Input variables (chronological and geological data) are critical in determining the precise site of an upcoming earthquake. It is good to use remote sensors with GIS since it saves time and money. money.

In this work, GIS methods were utilized to forecast the precise location of earthquakes in Iraq. GIS software need reliable data (Data Base (DB)) regarding the variables that are important and useful in earthquake prediction in order to deliver accurate findings. These factors can be boiled down to three key ones despite being numerous. The times, amplitudes, and locations of earlier earthquakes are these parameters. In general, future earthquake zones and seismic risk areas will always be in or close to prior earthquake zones. zones. Zones(Onur et al 2019).



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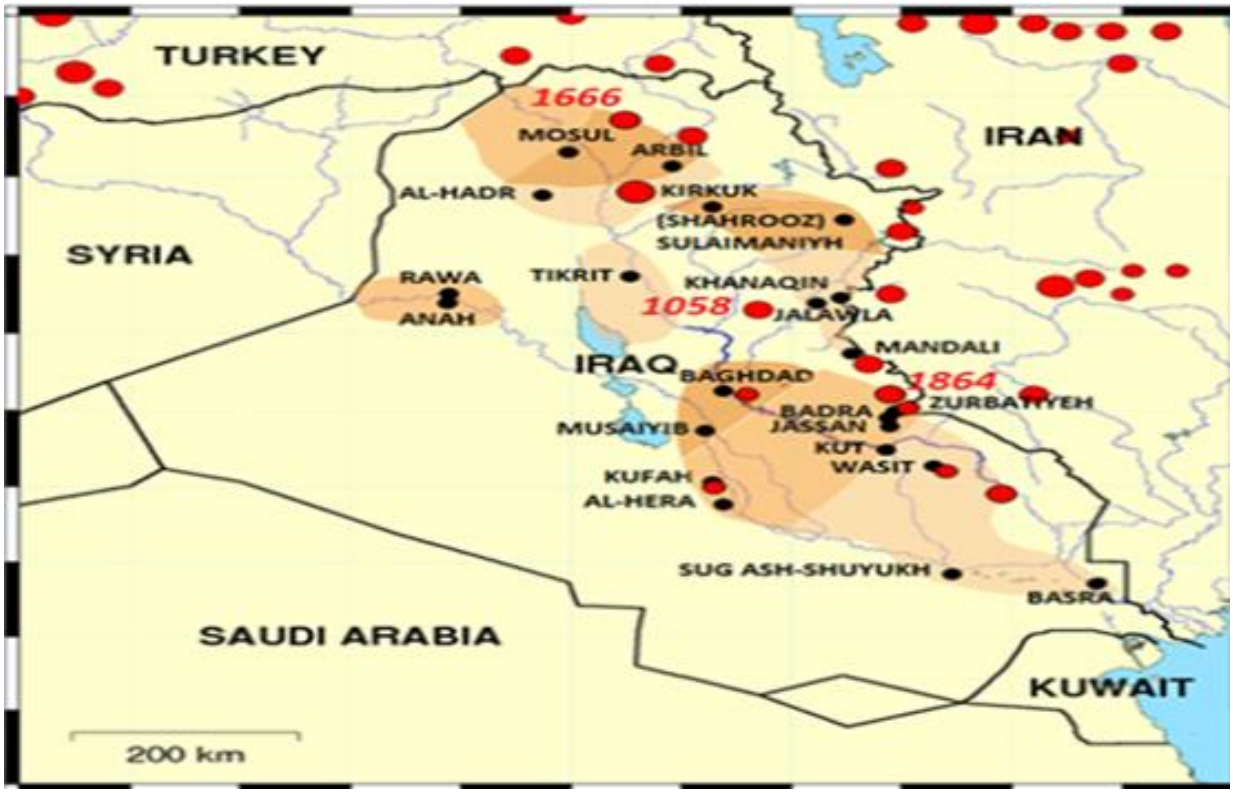
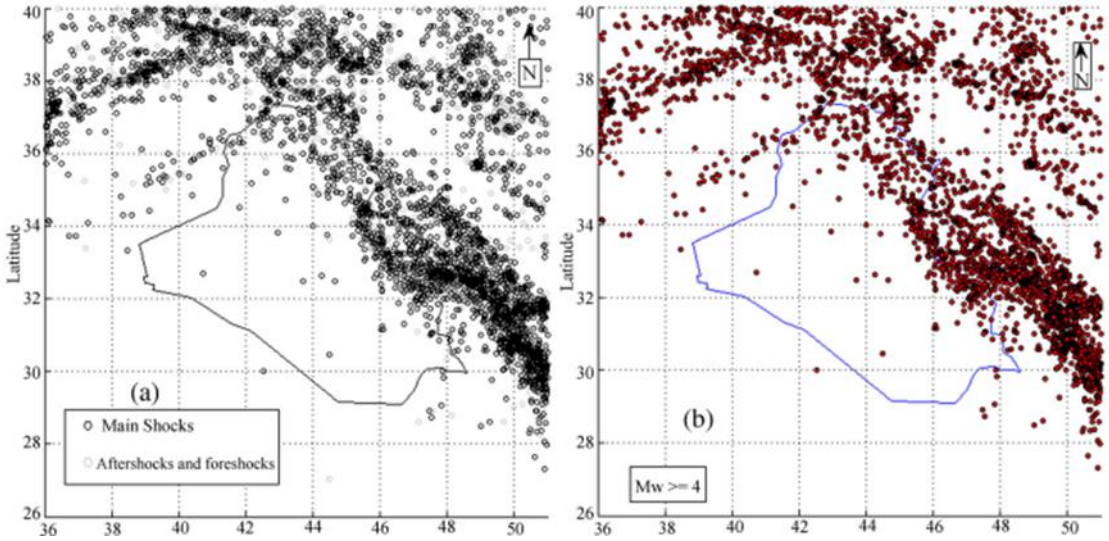



***Figure 6.*** *A map of past earthquakes east of Iraq during the periods*



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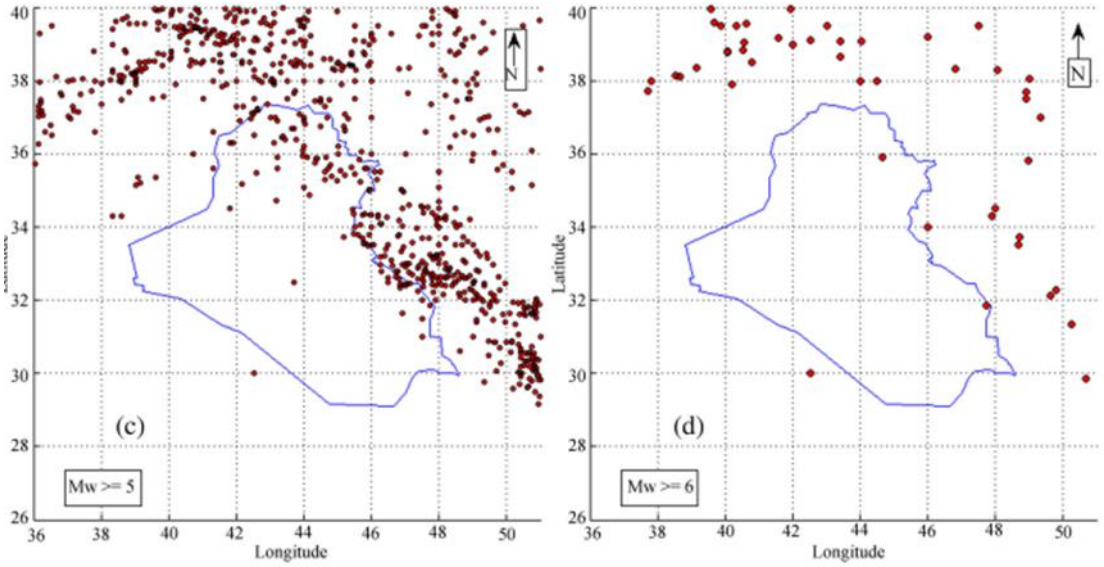


***Figure 7.*** *The four data sources earthquakes. b Information from Iran. c Iraqi seismic code data d Turkish information ((2015).*

*(1985-2015); earthquakes in Iraq. In which the bleakest shaded areas imply the most earthquakes felt. Small circles represent Mw 6, medium circles Mw 7, and big circles Mw 8. Mw ≥7.*

### 3.1. GIS and Prediction Earthquakes in Iraq

It is both a natural occurrence and a natural disaster. It has the potential to cause huge damage and loss of life. Natural disasters can be predicted in the future in order to reduce their dangers and protect people and property. The magnitude of upcoming seismic occurrences can be predicted and estimated with great accuracy using GIS forecasting. By building a GIS database (DB) of the last earthquake, the position of future earthquakes in eastern Iraq can be predicted using GIS techniques. for the same period. This is useful for forecasting and analyzing future natural disasters or earthquakes. It is feasible to use various complex statistical initiatives to forecast future earthquakes.

GIS databases can demonstrate that the statistical tests developed were crucial and efficient in predicting upcoming earthquakes. Traditional earthquake forecasting methods, on the other hand, are largely ineffective. The use and analysis of satellite data and imagery can estimate the magnitude of major earthquakes that have. There is a wide range of software available Software such as ERDAS Imagine, ER Mapped, and GIS are used to process, show, and analyze, improve satellite imagery for necessary information. Thus, GIS software and databases can produce cutting-edge techniques for analyzing satellite imagery and forecasting impending natural disasters. Predicting and using GIS forecasting and monitoring the landslide risk tool for predicting the effects of impending natural disasters It can also be used to forecast organic earthquakes' locations. however, GIS is used to assess the risk of earthquakes (see Figure 6). To mitigate the effects of earthquakes, there are several factors to consider, including the source of the land, the length of time, the GIS database of earthquakes (see Figures 7 and 8), and the use of knowledge in

Table 1 to identify and describe emergency management activities.



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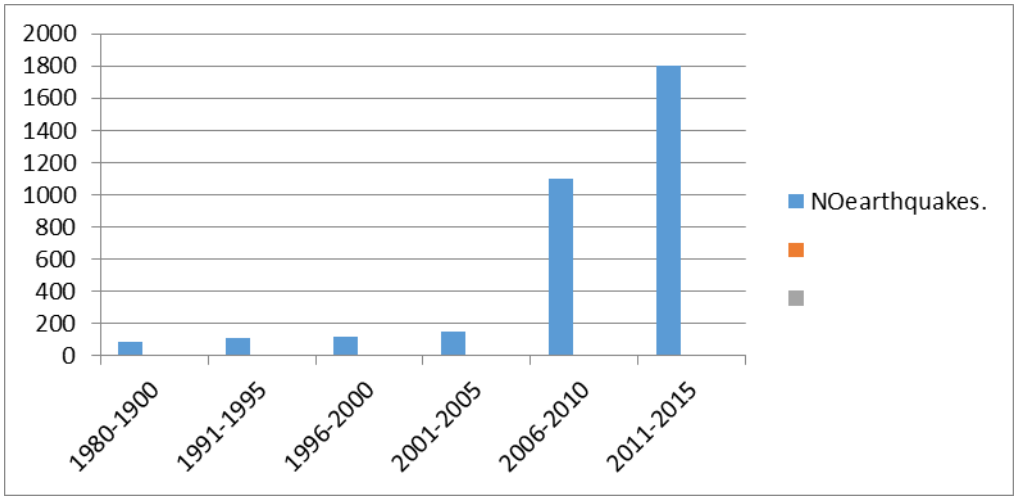


***Figure 8**. Blue Number of earthquakes in Iraq (1985-2015).*

| B | A | |
|---|---|---|
| NOearthquake | years | 1 |
| 85 | 1980-1900 | 2 |
| 110 | 1991-1995 | 3 |
| 120 | 1996-2000 | 4 |
| 150 | 2001-2005 | 5 |
| 1100 | 2006-2010 | 6 |
| 1800 | 2011-2015 | 7 |

***Figure 8** Database, A is years, B is Numbers of earthquakes in Iraq (1985-2015)3.*

### 3.2. Predicting Process Description

The forecasting method is primarily based on an earthquake prognostication supposition (1985-2015), and you should follow the steps below:

1. The ranges between previous earthquakes expanded to a modified distance; hence, it is almost probable that the following earthquakes will happen within that distance.
2. Sorting previous earthquakes according to the time period.(2015-1985)
3. Attaching the entire database (attribute, raster, and vector data) to ArcGIS, solely taking into account earthquakes that were place in the study area region.
4. Applying the forecasting model to data analysis in ArcGIS.
5. Creating a new seismographic line prediction map in ArcGIS.
6. Evaluating the outcomes by examining the location of the upcoming seismic events where they are expected.

## 4. RESULT

The following are the outcomes of the sandstorms and dust storms:

***a.*** It has an impact on Iraq's human life and infrastructure.
***b.*** It originates in the north west, middle west, and south west (Syria, Jordan, and Saudi Arabia).
***c.*** Taken from a GIS database. Sandstorms are raging in Bagdad, the middle of Iraq's south, and slowly in the north.
***d.*** Management must identify the sources of Sandstorms, the time of occurrence, and use remote sensors and GIS. The results for the Earthquakes are the following:
   1. It has the potential to cause massive damage and loss of life.
   2. Ancient Mesopotamia zone along Iraq's and Iran's northeastern frontiers.
   3. The biggest effect that occurs in Iran and sometimes in Iraq.
   4. Predicting and GIS the best way to obtain the effect of earthquakes in Iraq.
   5. GIS database show increase in earthquakes with increases of years.



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## CONCLUSIONS

From this paper we can conclude the following:

**a.** Iraq is among the nations. location all located an area where dust and sand storms from the north, middle, and south west consistently hit and broaden for a few days. The primary causes of this storm are time constraints to become wet, which results in the loss of green space due to insufficient rain and ineffectual farming. Remote stoners and GIS are used in the Emergency Management System to mitigate disasters.

**b.** A map depicting the GIS tools were used to create locations of coming earthquakes in the eastern section of Iraq. This entails producing a GIS database (DB) the preceding quake in the time frame (1985 - 2015). Right To life Mitigation Management System

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