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Monitoring the decline of water in lakes and reservoirs with remote sensing and geographic information systems

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Abstract

In this study, remote sensing and geographic information systems were used to track the decrease of the lakes. It was highlighted that traditional methods of studying huge regions are costly and time-consuming, and are out of step with current scientific and technological advances. In this study, the changing area covered by lakes was monitored using satellite photos taken at various time intervals of Lake Habbania, Qadisia reservoir, Razaza, and Thrthar Lake have been tracking the change in water-covered regions. The study concluded that the great depression poses a threat to the environment of those water bodies and land surrounding and associated with it, which reached a peak in the Razaz lake, which declined by 68% in 2010 than they were in 2005, and the volume of water has declined by 88%, and in the Qadisia reservoir, which receded water for 33% of the area submerged so the reservoir between 2000 and 2005, and the volume of water has declined by 44%. This demonstrates the presence of severe environmental danger affecting the Euphrates basin from Haditha Dam to the mouth of the Shatt al-Arab.

1. Introduction

The storage and supply of river water in lakes and dam tanks are extremely important and play an important role in the preservation of civilian life by preventing flooding, controlling water management for irrigation, power generation, other development and economic uses such as tourism and the development of fish stocks. The main benefit of the application of remote sensing

and geographic information systems (GIS) in water is the ease of updating and developing the databases associated with those water bodies linked to river basins, thus enabling water operators to link geographic information, such as water basins, with graphical information, such as rain and water rise, where GIS can be used together for various studies and analyses in the construction and management of large water projects, such as dams, reservoirs, cataracts, etc. The application of GIS in the area of water study has acquired a special strategic dimension. Water is one of the environmental components that needs to be managed and rationalized (May 2003), since it can be considered the most dominant element in environmental management and the most visible indicator in the monitoring of various environmental changes. The linkage between GIS and spatial data analysis is critical to the exploration and analysis of spatial relationships (Duikat 2003). The decline of water in reservoirs and lakes is accompanied by changes in water quality characteristics. These qualitative changes have more impact on lake water than on river water (Nahimi 2005). Monitoring of water erosion using traditional methods is costly and requires considerable time. In this research, modern techniques have been used to monitor the water decline of both Hadetha dam and lake, aThrthar lake, razazabbania lake

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2. Description of the area of study

habbania lake : The lake is located on the right bank of the Euphrates River on the southern side of the Euphrates River between latitudes 33-10-33 north and longitudes 43-15-43 45 east. The lake was used to mitigate the threat of flooding when water levels in the Euphrates River rise to their highest levels. The lake has a surface area of 426 square kilometres, when the lake level is 51 metres above sea level, when the maximum absorption is 3.26 billion cubic metres, including dead storage, 36 metres of lake floor, 42.5 metres of dead storage and 0.6 billion cubic metres of annual evaporation**.**

razaz Lake : This lake is located 15 kilometres south of the city of Karbala 43 22-43 54 east 32 25-33 53 north and is the second largest water flat after the chatter, with a total area of 1842 square kilometres at 40 metres of 26 billion cubic metres

Thrthar lake: The lake is located 120 kilometres north-west of Baghdad between the Tigris and Euphrates rivers, with the highest storage level in Lake 65 metres above the surface of the sea cube and its area at 2050 cubic kilometres. The storage area is 85.59 billion cubic metres. The dead storage level is 40 metres above sea level and the storage volume is 35.18 billion cubic metres.

Hadetha lake : This lake has an area of 503 square kilometres and the highest storage level is 147 metres above sea level, 8.28 billion cubic metres, and the dead storage is 3 billion cubic metres.

3. Aim of the study

The aim of the research is to use remote sensing and GIS techniques to monitor the decline of surface areas covered by large water bodies and the change in storage volumes caused by water scarcity in recent years and to study the effects of such decline to assist decision makers in the areas of water resource management and monitoring and monitoring of environmental parameters associated with degradation.

4. Practical Part

The programme (ERDAS 9.2) was used for the purpose of digital processing and analysis of satellite image data. Images of study areas were presented and used. Unsupervised classification was carried out. The results showed that the study areas were divided into five different features based on the spectral reflection values of satellite images for the purpose of clarifying water boundaries as shown in the forms (1, 2, 3 and 4) and for all years.

Arc view 3.2 was used to calculate surface areas of satellite images used for study areas as shown in table 1 and forms 5.6.7.8.

Through the resulting values, the levels and quantities of storage per water flat were calculated by the data representing the relationship between the surface area of the water and the attributed area. The amount of storage shows a significant discrepancy in the surface area of the razaz laker, which was 68% lower in 2010 than it was in 2005, and the amount of storage was 88% lower and is clearly shown in figure 9.

5. Results and Discussion

By this study we find that these water bodies monitored by this study were facing real dangerous threatens them environment. The decline of water in Razaza Lake reached to about 68% between 2005 and 2010. Figures bellow explain some of our results and table 1 includes all the results.

Table 1 Water Body Areas and Volumes with date

No	Water Body Name	Image Date	Area	Volume Billion m^3
1	Haditha	2000	383	5.8
	Haditha	2003	313	4.3
	Haditha	2005	257	3.2
2	Thirthar	2000	1641	43.7
	Thirthar	2003	1595	41.8
3	Habania	2000	182	0.53
	Habania	2003	145	0.39
	Habania	2005	197	0.68
	Habania	2010	202	0.71
4	Razaza	2000	1134	5.9
	Razaza	2003	957	4.2
	Razaza	2005	1213	6.9
	Razaza	2010	381	0.8

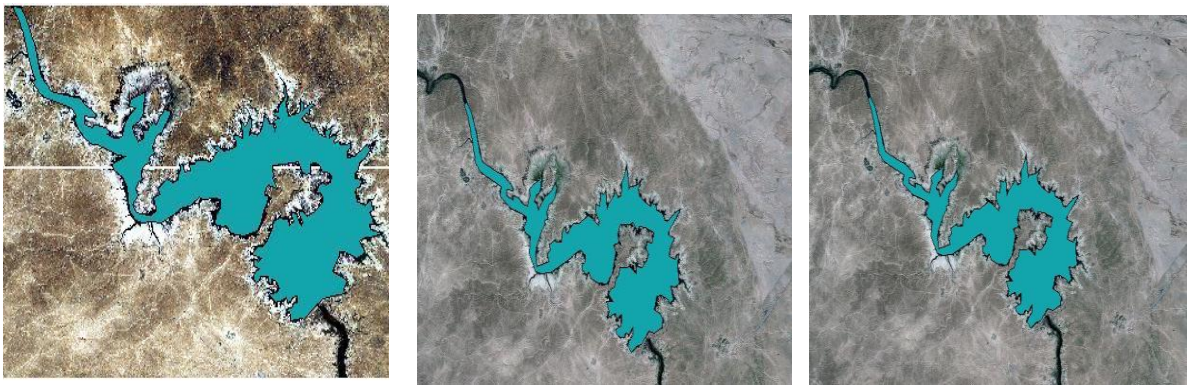

Fig 1. Haditha Lake in 2000, 2003, 2005 respectively from left

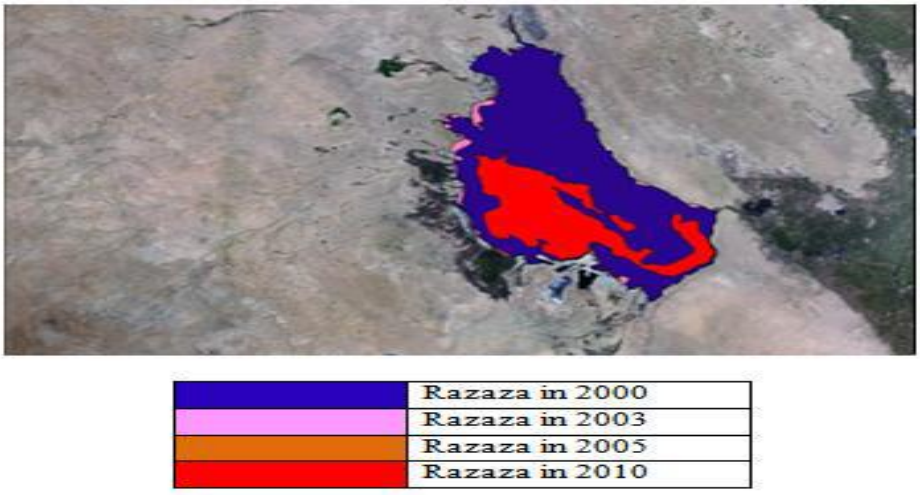

Fig 2. Razaz Lake with dates

Conclusion

he study of surface areas of reservoir water and dams found that there was a real threat to the environment of those bodies due to a significant decline in water, which reached a maximum of 68 per cent in razaz lake between 2005 and 2010, and the amount of storage fell by 88 per cent between those two years, while the water was reduced by one third of the submerged area between 2000 and 2005in Haditha dam.

The effect of this decline on the water quality and environment of these areas requires researchers to expand the study of this problem in order to provide appropriate solutions and recommendations to reduce the risks posed by it. Our research team has therefore adopted the process of data collection for the preparation of subsequent studies on the effects of water quality caused by the erosion of flats through the use of remote sensory techniques to monitor changes, calculate water quantity and prepare databases to study different effects.

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