Journal of Information Engineering and Applications
ISSN 2224-5782 (print) ISSN 2225-0506 (online)
Vol.14, No.2, 2024

Utilize Geographic Information Systems to Find the Rates of Extinction of Archaeological Site Case study (Clover-leaf site)

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ABSTRACT.

This paper focuses on utilizing remote sensing and geographic information systems to create digital maps of archaeological sites and their surroundings. The old aerial images are used as a visual reference to draw all the features, while modern satellite images of the same site and geographical coordinates are superimposed on top of the aerial image. The maps aim to capture the changes caused by human intervention, neglect, and the expansion of unorganized populations. Specifically, the study area is the Cloverleaf horse racing arena in the city of Samarra, and the GIS software ArcGIS Pro is used. The outcome of the study is that the chosen location has experienced complete destruction, with a 100% destruction rate.

Keywords: GIS, Clover-leaf, ArcGIS, Al-Mutawakkil, geo-information.

DOI: 10.7176/JIEA/14-2-04
Publication date: June 30th 2024

1. INTRODUCTION.

Managing excavation information requires knowledge and expertise from various interdisciplinary fields such as computer science and archaeology. This includes familiarity with modern techniques in database design, Geographical Information Systems (GIS), 3D Reality Modelling, digital reconstruction, and spatial analysis. In recent years, the integration of new technologies has transformed archaeological research, providing researchers with tools that can assist them in their excavation activities [1]. Remote sensing and geographic information systems provide mapping, analysis, and spatial and descriptive databases. The precise installation of geographical locations for archaeological sites using a Global Positioning System (GPS) is a crucial term in GIS systems. When reaching certain archaeological sites becomes challenging, researchers rely on coordinates provided by the Archaeological Authority, which is then converted into maps and transformed into databases that contain location data [2].Iraq is one of the most important countries in the world, which is rich in archaeological sites that return to different civilizations and periods of time [3], which must be preserved by modern scientific means The archaeological heritage of peoples and a source of pride and importance for successive generations and the historical and economic importance of the other economic sources of some countries in which tourism is a source of economic resources[4].This research has utilized the findings to address the issue of anthropological degradation caused by human interference as its primary approach for problem-solving.

2. STUDY REGION.

Located on the banks of the Tigris River about 125 km north of Baghdad at(34.218778" N 43.88847 "E) (Fig. 1). The archaeological city of Samarra served as the capital of the Abbasid Islamic state during the reign of Calipha (Mu'tasim Bellah), and the city itself spans 41Km from north to south and 4 to 8 Km in width [5]. The city is home to numerous archaeological architectural and technical monuments, some of which were developed locally before being transported to other regions of the Islamic world and beyond.The Cloverleaf, located approximately 1Km north of the Congregational Mosque of Al-Mutawakkil and southeast of the Dar Al-Khilafa, is comprised of four circles that are connected by a central cross (Fig. 2). The inner and outer lines of these circles delineate a continuous track with a mostly regular width of approximately 78 meters, but which reduces to 69 meters at certain points. The length of the circuit, if measured as the center-line of the course, is about 5310 meters, although it is unclear which line is most appropriate for measuring its length given the substantial difference in length between the inside and outside of the curve. The surviving trace of the layout is marked by a low mound that rises to approximately 50 centimeters and is defined by a visible wall of earth that measures 1.46 meters wide. A 180-meter gap in the outer wall on the city side may have served as an entrance for horses, and four symmetrical entrances provide access to the center where the outer wall approaches closest to the center point. At the diamond points, rectangular

depressions measuring approximately 10 meters long and 7 meters wide can be found. On the north and east sides, a rectangular block measuring 6 * 2.5 meters can be seen in the center of these depressions, while the remains on the other two sides are less clear. It is speculated that the four plinths were used to carry monumental markers [5].

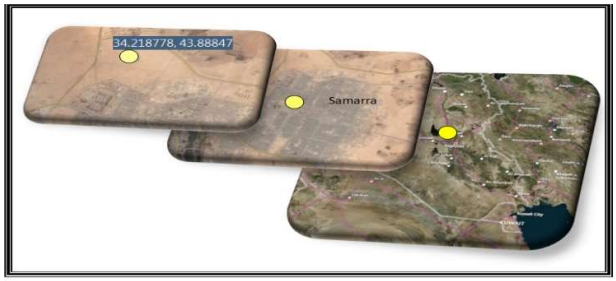


Fig. (1).

3. RESEARCH METHODOLOGY.

Technological advancements in high-resolution imagery and spatial data processing programs, the scientific area of using remote sensing data for geo-information mapping of archaeological sites is currently undergoing active development. By applying reasonable visualization and geo-information analysis techniques to this data, we can uncover patterns in the distribution of archaeological objects [6]. The aerial photographs of some archaeological areas of Iraq were used in the early part of the last century 26/8/1918 [7]. These images have enabled a clear view of the archeological sites of most archaeological areas before they were overstated and obscured. These images (Fig.2) allow accurate mapping and conversion into a digital map using software systems Geographic information (ArcGIS pro).

Fig. 2.

main source for the representation of spatial data represented by the obvious archaeological parameters, a digital map of the features was drawn based on the old aerial image [7] (Fig.3) and geographical coordinates are divided according to some of the features that have been identified so far, Linear and digital map of the archaeological features as shown in (Fig.4 a.b).

Fig.3.

Fig. (4.a)

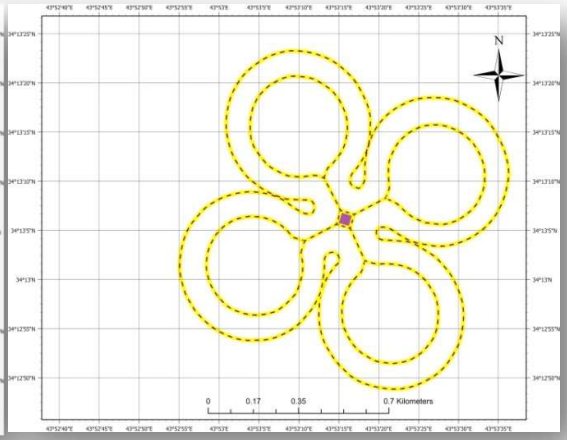
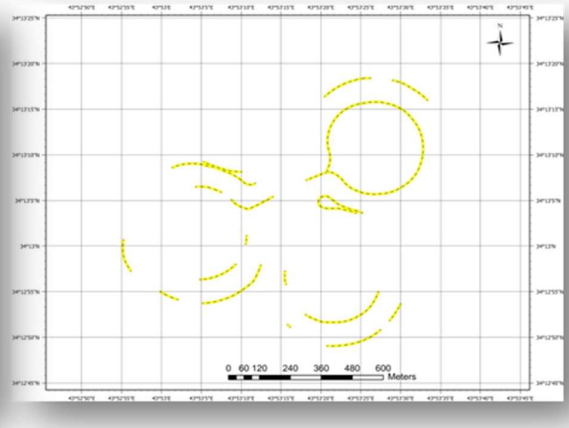


Fig (4.b)

The satellite image was selected of the same archaeological area as the archaeological site, after that, the archaeological features were represented digitally based on satellite images from different time periods. Fig. (5. a.b) is a satellite image of its source (SAS.Planet) which was projected onto the coordinates (WGS 1984) of the study area in the year (2005) It shows the apparent change of the archaeological features and the bulldozing of most of its parts for agricultural use and transportation between (1918-2005).



Fig(5.a) Fig(5.b)

Fig. (6.a.b) is a satellite image sourced from (Google Earth) of the study area in the year (2014), the beginning of the urban use of the lands surrounding the archaeological features

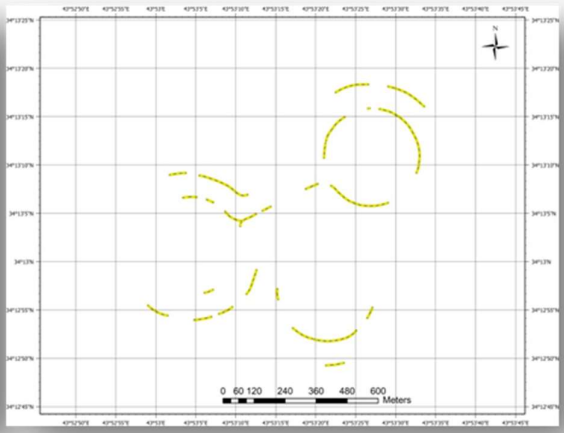


Fig.(6.a) Fig.(6.b)

Fig.(7.a.b) is a satellite image its source (ESRI\ArcGIS.Imagery) and its coordinates are based on the (WGS 1984) system.of the study area in the year (2017), The pace of exploitation of the archaeological features site for residential construction has escalated, and its parts have been completely destroyed

Fig.(7.a)

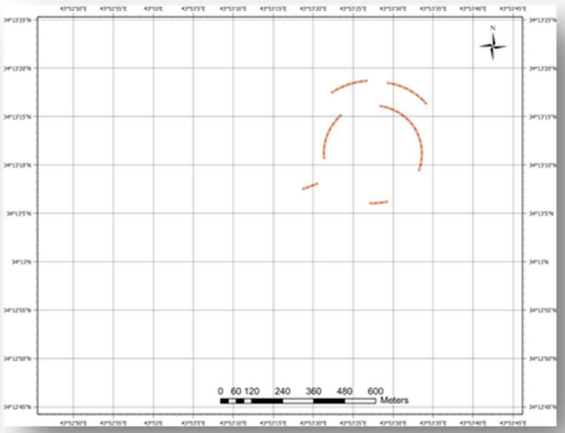
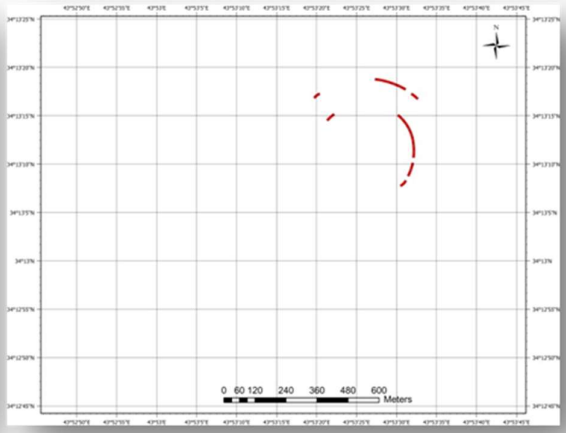


Fig.(7.b)

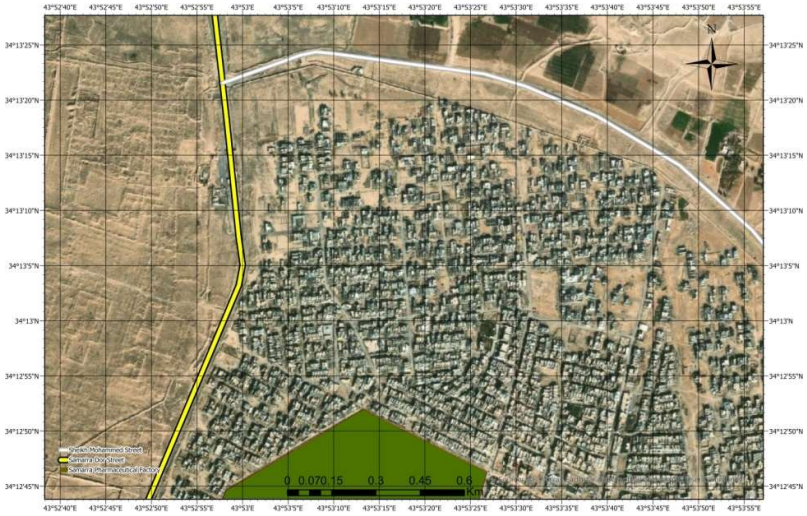
Fig. (8.a.b) is a satellite image of its source (ESRI\ArcGIS.Imagery) and its coordinates are based on the (WGS 1984) system of the study area in the year (2019), shows the full exploitation of the archaeological site and its conversion into a random residential area, and the survival of a small part of the archaeological features that can only be easily distinguished from above.

Fig(8.a)



Fig(8.b)

Fig.(9) is a satellite image of its source (ESRI\ArcGIS.Imagery) and its coordinates are based on the (WGS 1984) system of the study area in the year (2020), The archaeological features have completely disappeared



Fig(9)

The extinction rates were calculated using the functions included in the ArcGIS software[8] for all the years approved in the study, which were based on the availability of data (satellite images), which provide data for the archaeological site.

4. THE RESULTS

The extinction rates were calculated using the functions included in the ArcGIS software[8] for all the years approved in the study, which were based on the availability of data (satellite images), which provide data for the archaeological site. The obtained output table (1) and Fig(10) indicate The magnitude of extinction and destruction occurring is of great concern due to its substantial rate (65.3%) for the archaeological feature in a period (1918-2005), and the extinction accelerated during a very short period (2006-2020) compared to the years of the antiquities life, to reach a percentage of (100%), As a result of the increasing population and the lack of attention from consecutive administrations towards the archaeological sites in Samarra, these sites have suffered. The percentage of extinction that was calculated is only due to the human factor and did not include the factors of time and climate.

Table 9.Percentage of extinction during the time period (1918-2020)

Year's	1918	2005	2014	2017	2019	2020
Length (Meter)	10165	3522	2571	990	499	0
Extinction Rate	0%	65.3%	74.7%	90.2%	95%	100%

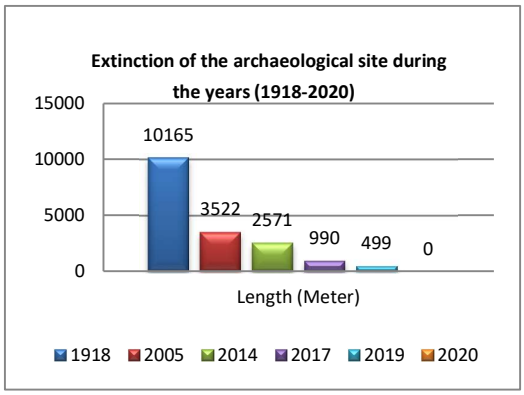


Fig. 10

5. Conclusion

1. The use of remote sensing and GIS in this area has played a major role in accurately identifying the problem.

2. There is no use to limit geographic information systems in any of the city's service, tourism and archaeological services.

3. If archaeological sites are not given adequate attention, the rate of destruction in these sites could be considerably high and occur rapidly in comparison to the relatively brief period of site archaeological the weak role of the departments concerned with archaeology in the preservation of archaeological sites.

6. References

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