DIGITAL MAPPING FOR THE HISTORICAL VILLAGES SITES AS MONUMENT RESERVES, A GEOGRAPHICAL STUDY IN BASSOUNA AND BANAWIT VILLAGES, ALMARAGHA DISTRICT, SOHAG, EGYPT

Dr. Ismail Ali Ismail Mohamed

Assistant Professor of Human Geography, Department Surveying of Natural Resources in Environmental Systems, Environmental Studies and Research Institute, University of Sadat City.
Ismail.Mohamed@esri.usc.eg

Abstract

This research focuses on ancient villages in Upper Egypt, whose rural built-up areas arose prior to the Islamic conquest of Egypt, and which existed during the Pharaonic dynasties and the Greek, Roman, and Coptic periods that followed, and its built-up areas have lasted until now. The villages that are not included on touristic maps suffer from severe neglect of undiscovered archaeological treasures located beneath their rural built-up area and its surroundings, which are vulnerable to looting and theft, as well as a lack of spatial databases (recent digital maps) that allow the drawing of digital maps showing the classification of these villages based on the probability of the existence of undiscovered monuments. Achieving this matter is the first goal of the study. Second, creating digital maps to classify built-up areas and their surrounding areas within the administrative boundaries of the villages based on the possibility of undiscovered monuments' existence, the maps include particular places where the likelihood of the existence of monuments is extremely high, are considered rural reserves. **[Bul. Soc. Géog. d'Égypte, Special issue, 2022, pp. 59 - 102].**

Key Words: Historical villages; Digital mapping; Rural reserves of monuments; Al-Maragha District; Sohag Governorate; Egypt.

1) Introduction:

There are many historical Egyptian villages in Upper Egypt that contain monuments from the Pharaonic eras and subsequent historical periods, and the study focuses on those villages that are not on the Tourist map
In Egypt and suffer from neglect and the spread of monument theft without governmental supervision. The settlement expansion operations in these villages, as well as the replacement and renewal of the old mud brick blocks, and excavation operations for the purpose of constructing their infrastructure of water and sewage networks cause serious damage to the undiscovered monuments, which are frequently located a few meters from the surface of the earth in the Nile flood plain, due to the successive accumulation of silt brought with the flood, in the absence of a database of digital maps containing spatial and attribute

data that can be used to guide restoration work, Planning and construction of such villages. Traditional excavations for monuments destroy many monuments, and their slowness is exacerbated by the presence of many neglected recorded archaeological sites (Kaddous, 2008, p.129). As a result, unconventional methods such as geochemical analysis were required (Madariaga, 2021). In addition to geophysical methods that have been successful in detecting buried monuments in the ground (Hemeda, 2021, p93), remote sensing technology (Me Meyer, M.F., Pfeffer, I., and Jürgens, C. 2019), and geographic information systems (Chapman, 2006), this is what the study seeks in the two villages under investigation.

1.1) The study objectives:

-Determining specific criteria and variables by which the built-up areas of these historical villages and their surroundings can be classified within an administrative area based on the probability of the existence of monuments.
-Creating digital maps to classify these villages based on the likelihood of monument existence, so that these maps include specific areas with a high probability to considered rural monument reserves.

1.2) Study problems:

-Answering the question of the probability of the existence of monuments in different areas within the administrative boundaries of the two villages under consideration.
-Responding to the question of where the geographical identification of the area's most likely to have underground monuments within the administrative boundaries of the two villages under consideration is for the purpose of being considered rural reserves.

2) Materials and methods:

2.1) Study area:

The study area is represented by the administrative boundaries of the villages of Bassouna and Banawit, within the Nile River flood plain and on the western side of the river, which are all located in Al-Maragha District, Sohag Governorate, southern Egypt, in what is known as Upper Egypt, between Latitude 26º 39 ´ 48 ″ and 26º 43́ 41″ N, and longitude 31º 32´ 26″ and 31º 36´ 42″ E, south of Cairo city about 374 km, Figure 1. Bassouna village (733.3 acres) and Banawat village (1013.8 acres). The two villages were mentioned in historical sources; in the village of pneuit (banawit today), early nineteenth-century travellers saw inscribed blocks of a Ptolemaic temple; in the same source, the village of psonis (bassouna today), known to us through the mummy labels of its priestly families buried until the third century C.E. (Lopez, 2013, p120). The two villages are

located on the Nile River's flood plain, where the land is mostly flat. The contour line (58) meters runs through the two villages, which are approximately 6.7 kilometers apart. Every year, the Nile River floods the floodplain lands on its two sides in Egypt due to summer rains that fall on the Ethiopian plateau. Prior to the completion of the High Dam in 1968, the flood waters were causing the water level in the Nile Valley to rise several meters above the floodplain lands (Heggy, Sharkawy and Abotalib,2021). Because all Egyptian dwellings were built of mud bricks and silt, which is the soil of the black flood plain brought by the river's flood waters, these dwellings were subject to undermining with the arrival of flood waters every year, as was any rural settlement in Pharaonic Egypt until the modern era. Before the High Dam, the houses were built on an artificial hill that rises several yards above the flood plain to protect the mud buildings from flood waters (Ginau, 2017 Because Egypt's plain environment in the Nile Valley and its delta is a low plain environment with severe flatness, the smallest rise in river level has the same impact as the heaviest rains. In rugged areas, where the mountain environment and the lowest local height of contour lines are equivalent to the height of some mountains (Hamdan, 2020, first volume, p.900). This has resulted in a link between the ancient nuclei of those villages and the sites of what are known as "dry point settlements" (Tang, 2014), where settlements choose slightly elevated dry areas.

2.2) Pre- processing stage:

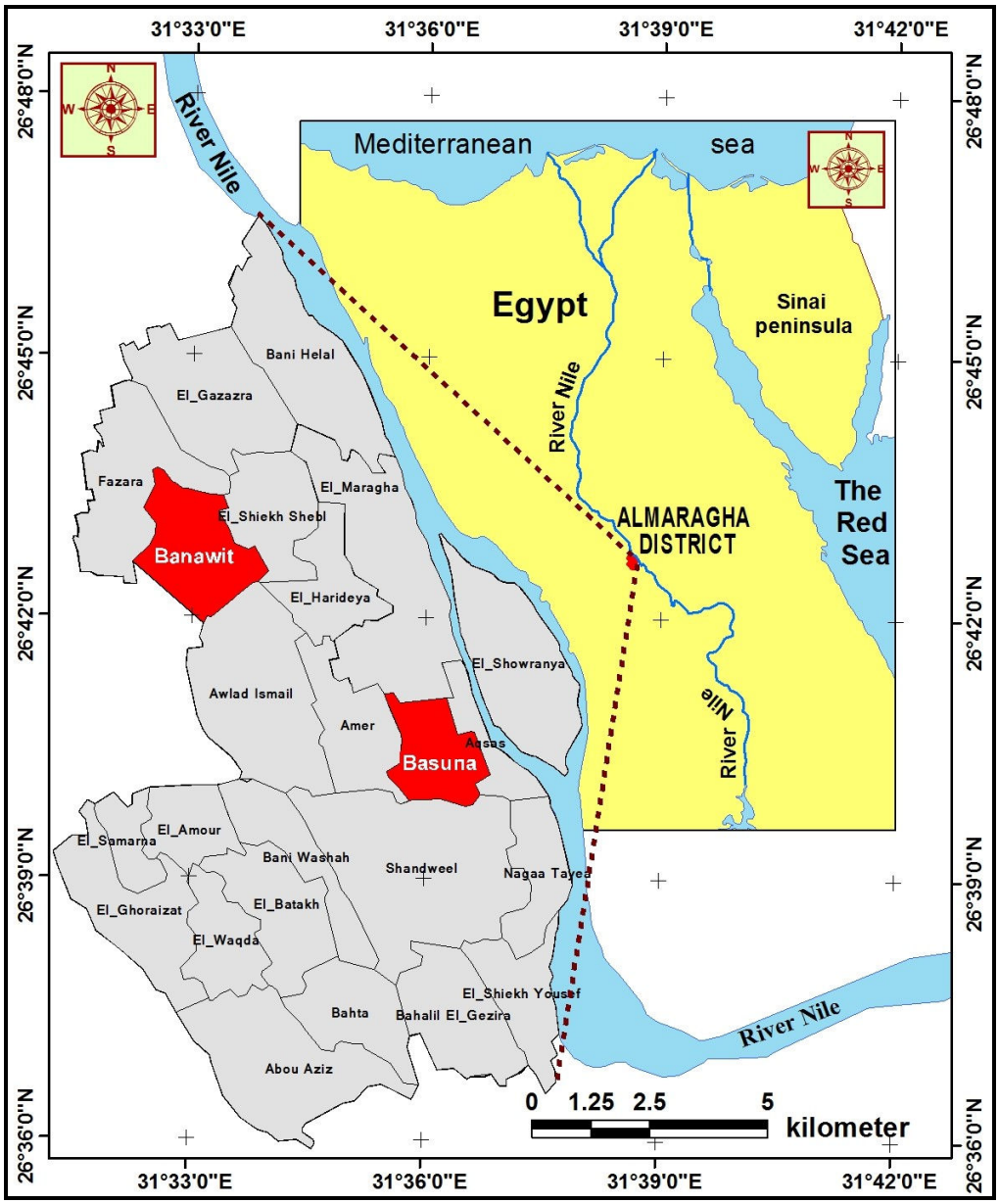
Analog maps dating back to 1809, 1907 AD, 1933 AD, and 1990 AD were used, where the old maps are one of the most important means of determining the most appropriate areas for excavating buried monuments (barker, 2005, p.39). , GIS technology was used, in addition to the Landsat 8 satellite image for the year 2021 AD, where RS technology was used, to separate the rural built-up area of the two villages from the rest of the land cover, in order to achieve the following goal:

2.2.1) Creating a layer stack:

The study used bands from 1:7 with a spatial resolution of 30m, where band 1 represents coastal aerosols, bands 2:4 visible light, and band 5 near infrared (NIR); it is useful for emphasizing biomass content (Roy et al.2014, p. 165). Band 6 short-wave infrared1 (SWIR1), which discriminates moisture content of soil and vegetation and penetrates thin clouds (With, 2019, p.149), and Band 7 short-wave infrared2 (Matejicek, 2017, p.135), which is useful for improving moisture content of soil and vegetation and thin cloud penetration.

2.2.2) PAN Sharpening imagery:

In order to pan-sharpen the multispectral image, Band 8 panchromatic (PAN) with a spatial resolution of 15 m was combined with the previous bands (Granshaw, 2020).



Source: *By the researcher, via the Arc GIS program, V.10.7.1, based on:*

1- Central Agency for Public Mobilization and Statistics, Geographic Information Systems Center, Administrative Map of the Arab Republic of Egypt, scale 1: 2,000,000, 2021 AD.

2- The Ministry of Communications and Information Technology, the electronic portal of Sohag Governorate, "Map of Maragha,". http://www.sohag.gov.eg/gov2/division/marakez.

Figure 1. The study area

2.3) Processing stage:

2.3.1) Radiometric correction:

- Haze reduction:

-Noise reduction: it is a statistical variation in measurements caused by random imaging processes (Borra, Thanki and Day, 2019, p.15).
- Histogram equalization: this allows for the areas of lower local contrast to gain a higher contrast (Mitchell, 2010, p.66).

2.3.2) Conducting the Hybrid Classification of the 2021 Satellite Image:

To separate the built-up areas of the two villages in the study area into one separate layer.

2.3.3) Converting classified satellite image 2021 file from raster data to polygon vector format:

To deal according to one measuring ruler with the satellite image and the vector data layers of rural settlement, created by the digitizing process, and obtained from the different analog maps. (Figure2).

3) Change detection in the image of the built-up area in the two studied villages.

3.1) The most essential of these objectives are:

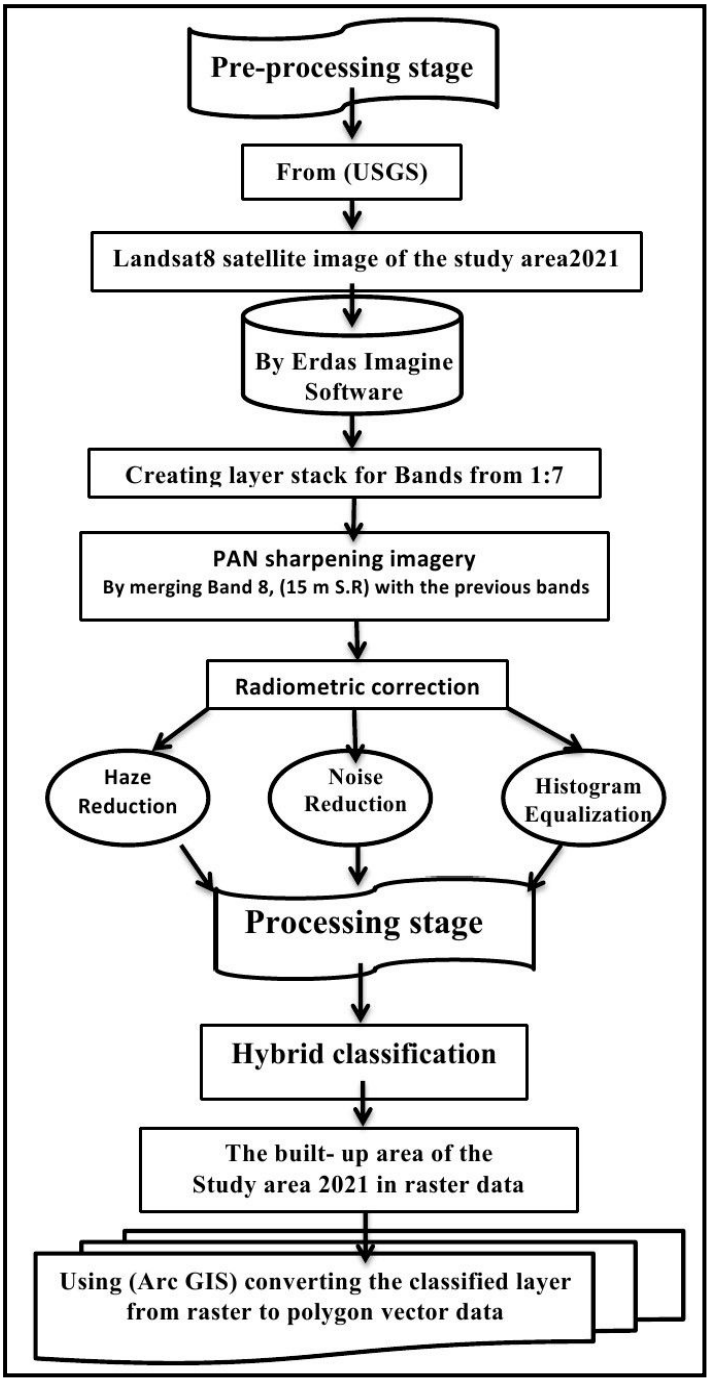
3.1.1) Knowing the ageing degrees of built-up areas to identify the geographical dimensions of the ancient settlement core or cores; where the likelihood of the existence of monuments underneath the built area grows with the link of its origin to earlier times (Liu, 2016, pp. 45-51). Furthermore, this is connected to defining the geographical dimensions of the factors recommended to calculate the dimensions of archaeological reserves.

3.1.2) Determining the degree of age of the built-up region is an essential and dependable component in developing maps of the research area based on the likelihood of the existence of monuments.

3.1.3) The monitoring of the occurrence of the demise of the ancient built-up regions with mud bricks to be replaced by agricultural fields is an indicator that the monuments will be more likely to be discovered (Blagovidova,2021).

3.1.4) Determining where present concrete expansion zones (on the study's maps) should be categorized as having a lesser likelihood of monuments surviving beneath them.

3.1.5) Determining the yearly average rate of settlement expansion and its directions because of its future direct influence on some places where the chance of a monument's existence is high or extremely high.



Source: *Researcher design, according to the methodology.*

Figure 2. Pre-processing and processing stages

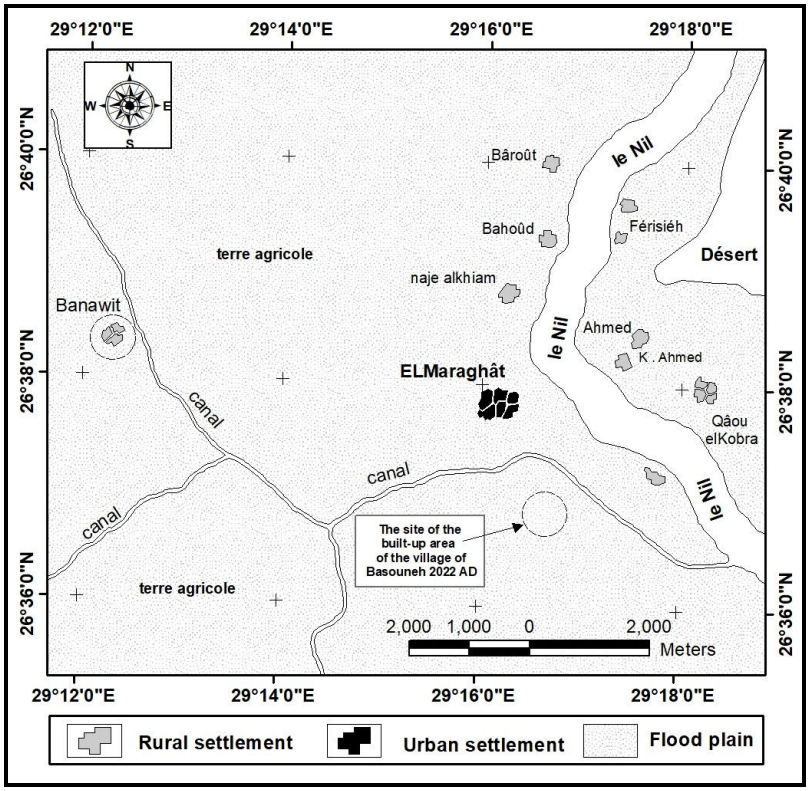
***Source**: field study, January, 10, 2021 AD,*

Photo (1):

***Source**: field study, January, 10, 2021 AD,*

Photo (2):

Photos 1, 2. Mud brick houses in Banawit village's historic nucleus, where the probability of discovering monuments beneath them is greater than in reinforced concrete dwellings houses.



Source: *Maps Hall, of the Egyptian Geographical Society, from the maps of the Atlas of the French campaign. Jacobin M., DESCRIPTION DE L ÉGYPTE, ATLAS GEOGRAPHIQE, PARIS, G, LF, PANCKOUCKE, 1809, TAHTAH, FLLe 11.*

Figure3.The study area according to the atlas of the French campaign

Although the map of the study area, according to the atlas of scholars of the French campaign, which dates back to 1809 AD, was drawn according to a projection and geo-referencing, it was noted that it was inaccurate, which was represented in the absence of the built-up area of the village of Bassouna, and there was a clear shifting of all geographical phenomena sites, which led to the exclusion of the map and the lack of reliance on it. Figure 3.

4) Changing the image of rural settlement during the period 1907–2021 AD.

4.1) Bassouna Village:

4.1.1) The built-up area in 1907 AD

According to Table 1, the built-up area appears to be a single compact village linked to the high artificial mound position, which protects the mud-brick buildings when the water level rises during the summer floods. According to the map, the built-up area reached 9.89 acres in 1907 AD.

- The village's built-up area has grown due to the establishment of new, minor, secondary rural nuclei distributed around the original and major nucleus. As it represents a stage from many stages of the development of the artificial mound in the village, this is the result of an expansion in the area of the high artificial mound, with the desire to increase the rural settlement area, which began to appear in the form of scattered nuclei drawing the boundaries of the round street. It is possible to say that the built-up area increased throughout that period. Like the design of the concentric zones is close to Burgess' concept (Okeke, p.98), where obvious characteristics of continuous round roadways were noticed as a result of the round mound's transformation throughout that period. Photos (3), and (4).

Table 1. Changes in the built-up area of Bassouna village between 1907 and 2021 AD.

Year	The residential area		Cemetery area		Annual average growth rate of the built-up area %
	(Sqm)	Acres	(Sqm)	acres	
1907	41531.6	9.89	——	——	——
1933	70927	16.89	——	——	2.7
1990	229460.3	54.6	——	——	3.9
2021	774378.9	184.34	——	——	7.4

Source: *By researcher, via the Arc GIS program. V.10.7.1.*

4.1.2) The change during the period from 1933 to 1990 AD:

- The built-up area has reverted to the appearance of compact settlements. This is a logical outcome reflecting the type of rural settlement that arises in river valleys (Chisholm, 2017, p.165). Because of the scarcity of fertile agricultural lands, the settlement appeared to be exceedingly compact. During this period, however, the village began to grow, becoming connected to the main paved roads and forming a north-south axis.
- It was also seen that the nucleus of a single, huge built-up area began to emerge, connecting to the secondary road northeast of the main built-up area.
- At the end of that period, the rural settlement had grown to 54.6 acres, with a 3.9 percent annual growth rate.

4.1.3) The change from 1990 to 2021 AD:

- The settlements spread in all directions and branched out in the shape of arms, with their expansion related to all linear phenomena such as major and secondary highways and water channels (Bani Hilal Canal). During this period, the village has seen a transformation from growth according to the Burgess model to sector theory expansion (Pacione, 2009, p.142).

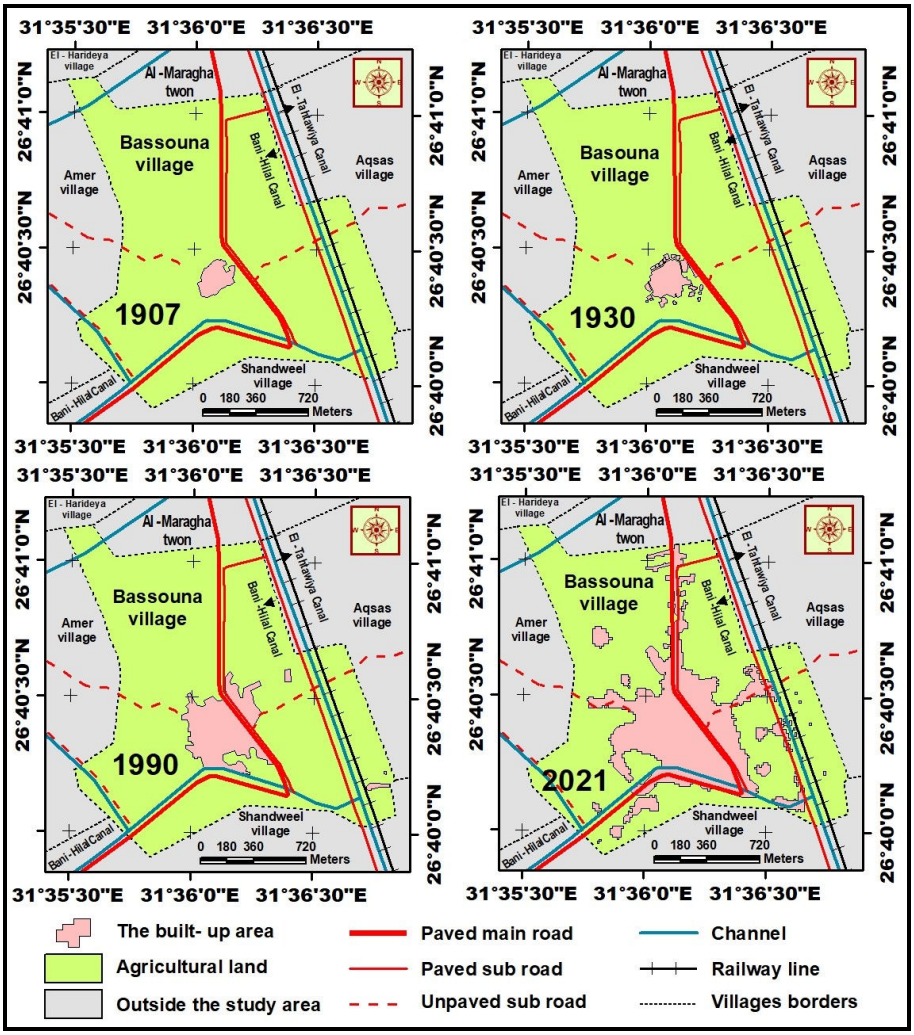
***Source**: field study, January, 10, 2021 AD.*

Photo (3): **photo (4):**

Photos 3, 4. The circular street's significant elevation difference reveals the boundaries of the old pharaonic village and the artificial mound, raising the potential for discovering monuments in the village of Bassouna.

- When the built-up area began to expand according to the sector theory, it was also expanding according to the multiple nuclei theory (Ullman, 2005) It was observed that many individual settlement nuclei appeared in the middle of the fertile agricultural lands, especially in the eastern part of the village, linked to the extension of the channels (Bani Hilal and Tahtawiya canals). Many little settlement nuclei start to appear on both sides of the railway line campus. The problem stems from the growth of settlements on agricultural lands east of the village, as this is the location where many examples of pharaonic mummies, known as the tapes by the locals, have been discovered. The region that appears to have been the location of a pharaonic cemetery and an old residential settlement has vanished or decreased, to be replaced by agricultural areas that have been covered by the thickness of the accumulated flood silt over the years. It must be taken into account when determining the sites of buried monuments, the flooding of rivers and the change in their course, or even the drying up of some of their branches, since this leads to migration of the population from those settlements, which become desolate and then vanish (Al-Shawky, 2013, p.26).

The change within the fertile flood lands from the compact settlements to the scattered settlements is the pattern which is usually found in the non-fertile lands



Source: *By the researcher, via the ArcGIS program V.10.7.1 and Erdas imagine.v.9.2software, based on:*

1-The General Survey of Egypt, Topographic Map, Scale 1: 50000, Maraga Plate, No. 3-17, S.E., Cairo, 1907.

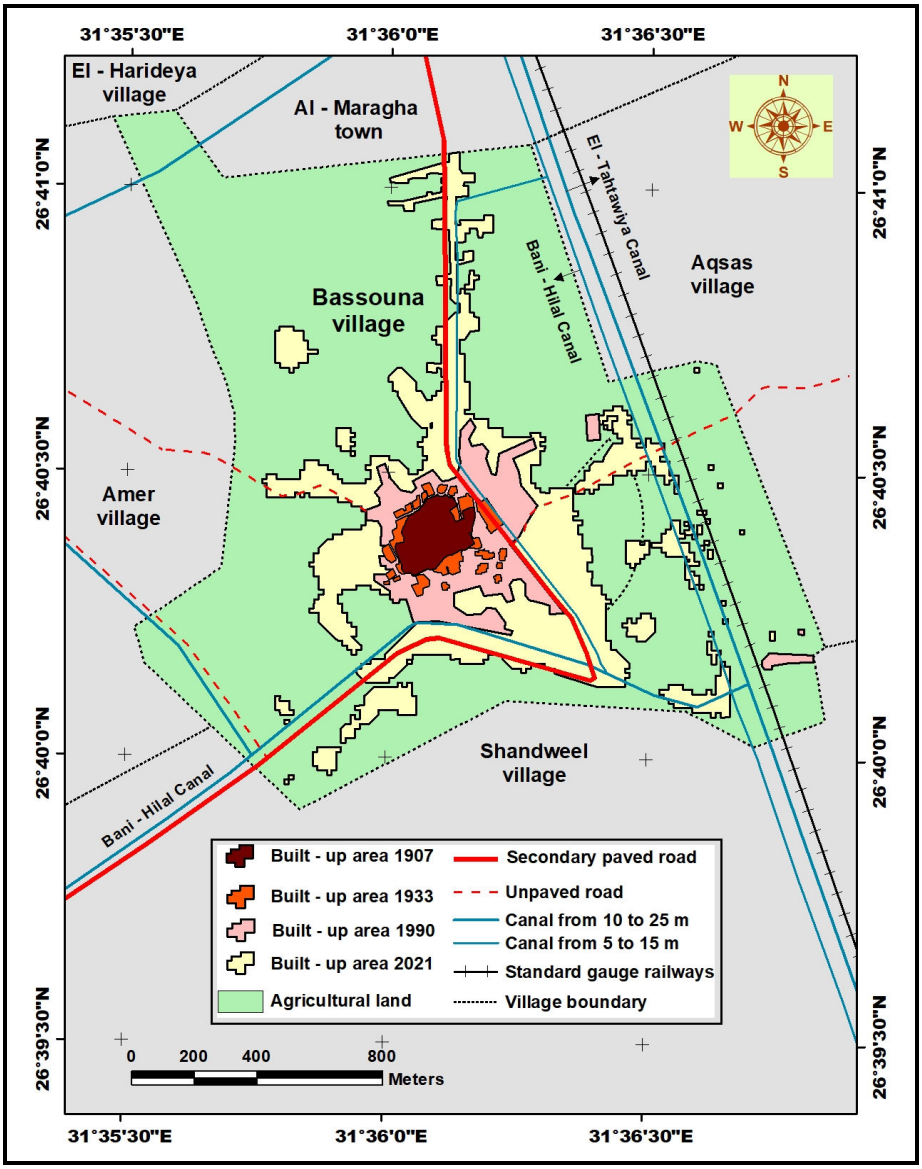
2-Survey Department, Map of the Topographical Project of Egypt, Scale 1: 25000, plate EL-Swaama Gharab, No. 44/660, Cairo, 1933.

3-Survey Department, Map of the Topographical Egypt Project, Scale 1: 25000, plate EL-Maragha, No. 44/676, Cairo, 1933.

4-Public Survey Authority, Finnish-American Topographical Map, Scale 1: 50000, Sohag Plate, No. NG36J4a, Cairo, 1990.

5-Landsat 8 satellite imager (OLI), July 24, 2021, Path 176, Row 41.

Figure 4.Stages of settlement growth in Bassouna Village from 1907 to 2021 AD.



Source: *The map was prepared and digitized by the researcher via the Arc GIS program V.10.7.1 and Erdas imagine.v.9.2 software, based on:*
The same satellite image and maps that were used in the previous figure.

Figure 5.Stages of changing the built-up area in Bassouna village 1907:2021.

(Dawson, 2007, p.8). On the desert margins of the Nile Valley in EgyptThis reflects the lack of control and deterrent legislation that restrict or prohibit expansion at the expense of agricultural areas, a trait connected with the end of this period due to political instability and the absence of a security grip (Eisa, 2022).

- By the conclusion of that period, the built-up area had grown to 184.3 acres, with an average annual settlement growth rate of 7.4 percent. Figures 3 and 4.

4.2) Banawit village:

Table 2. Changes in the built-up area of Banawit village between 1907 and 2021 AD

Year	The residential area		Cemetery area		The annual growth rate of the built-area %up
	(Sqm)	acres	(Sqm)	acres	
1907	49708.7	11.8	7442.6	1.77	——
1933	73608.7	17.5	10115.6	2.4	1.8
1990	149550.8	35.6	13936.4	3.3	1.8
2021	1168568.1	278.2	19997.5	4.76	21.3

***Source**: by researcher, via the Arc GIS program. V.10.7.1.*

It is clear from Table 2 and Figures 6, 7, and 8 that:

4.2.1) The built-up area in 1907 AD:

As illustrated in photo no. (5), in contrast to the former village, land uses include a geographical determination of an archaeological region and a Muslim cemetery area (1.77 acres). The village seemed to be compact as a single residential built-up area of 11.83 acres to the east of the archaeological area, separated from it by an area of unoccupied land only 52 meters south of the archaeological area's borders.
An (archaeological Pharaonic mound) made of mud bricks represents this archaeological location. Photo (6). Adobe construction does not always reflect primitive design; several Pharaonic pyramids were constructed with mud (Hamdan, 2020, second volume, pp. 420, 421). The Black Pyramid, or the Pyramid of Senusret III, was a pyramid made of mud bricks with a limestone covering that is now in the shape of a mound. It is formed of rubble and is termed "black" because of the color of the black mud bricks used to construct it (Abd El-Hafez and Fahmy, 2018; pp. 78-89). The similarity of (the archaeological mound) in Banawit to the Black Pyramid, as well as (the tombs of the Pharaonic

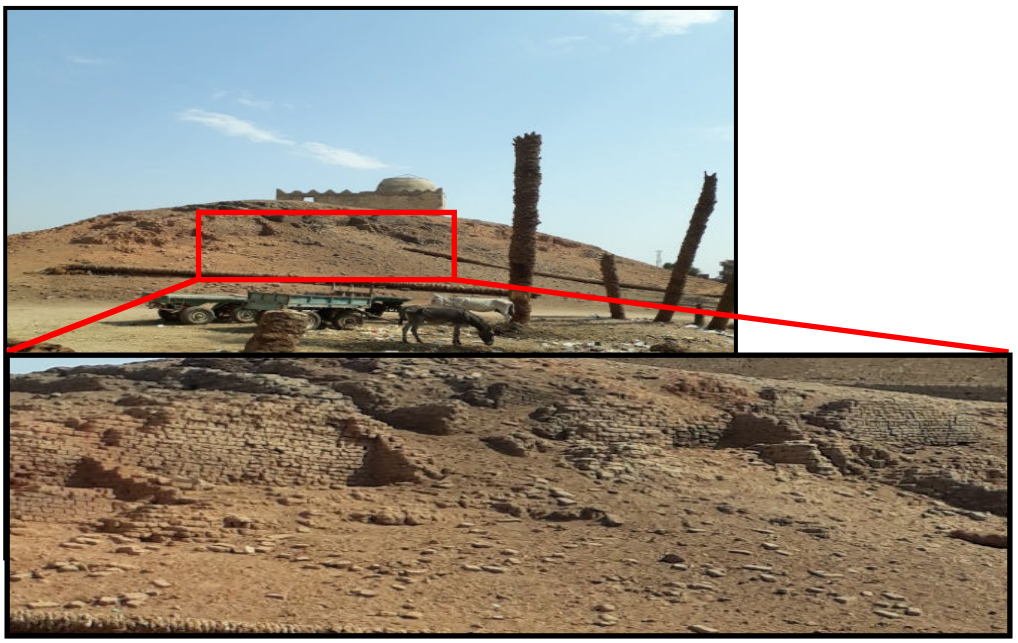
village of Beit Khalaf) to the south of the famous Pharaonic Abydos region in Sohag governorate near the study area (Fakery, 2012, pp271-273), emphasizes that the village's archaeological mound is the remains of a mud brick pharaonic pyramid. Photos (7), (8) and (9). Also, while digging the foundations for the school, which is located to the east and near to the mound archaeological site, a stone panel with hieroglyphic writing and pharaonic inscriptions was discovered. It depicts two ladies knelling and presenting gifts to the gods (Abdel Radi, 2013). This raises the likelihood that the mound is a mud pyramid. Photos, (10), (11).

***Source**: by the researcher depending on Google Earth, 2022.*

Photo 5. Briefing the land uses of the Archaeological mound in Banawit village.

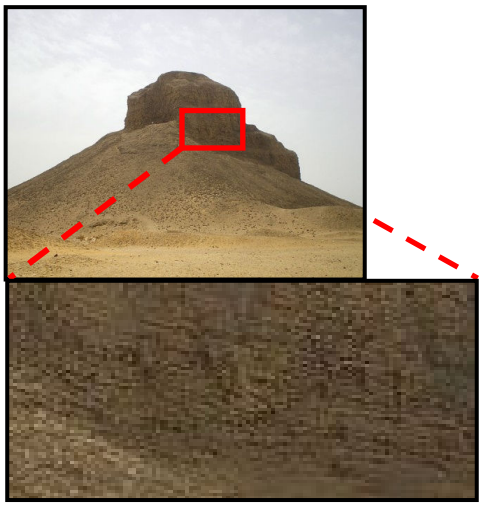
***Source:** by the researcher, field study, January, 10, 2021 AD, Looking toward the east.*

Photo 6. The archaeological mound in the village of Banawit.



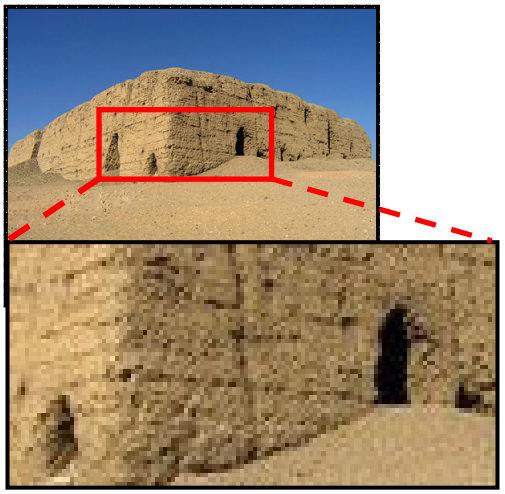
***Source**: by the researcher, field study, January, 10, 2021 AD, Looking towards the east.*

Photo 7. The method of building with mud bricks is similar in both The Mound in the village of Banawit, the black pyramid and the tombs of Beit Kalaf.



***Source**: Learn about the details of the "Black Pyramid of Dahshur"(Fathy, 2018)*

Photo 8. The black pyramid.



***Source** "Forgotten" the most important Monuments in Sohag. (Kamel, 2020).*

Photo 9. The tombs of Beit Kalaf

4.2.2) The change from 1907 to 1933 AD:

On the 1933 map, the residential area expanded slightly to the north and east, increasing to 17.5 acres with an annual growth rate of 1.8 percent, while the cemetery grew to the east, with no settlement expansions documented near the archaeological region.

4.2.3) The change from 1933 to 1990 AD:

- The dynamic of residential area and village cemetery growth demonstrated a continuation of the commitment to the existence of a vacant area that represents an area surrounding the borders of the archaeological mount; as the residential area grew towards the east, north, and northwest, avoiding the extension towards the west, leaving a vacant area around the archaeological mount.

- The cemetery continued to expand to the east, reaching the residential area but avoiding, like the residential area, the expansion to the north and the archaeological area's boundaries.

- By the end of that period, the residential area had grown to 35.6 acres, and the average annual settlement growth rate had stayed steady at 1.8 percent, as it had in the preceding period, while the cemetery area had grown to 3.32 acres.

4.2.4) The change from 1990 to 2021 AD:

- The hybrid classification of the satellite image revealed significant growth of the residential built-up area on all axes, at the expense of agricultural lands; on both sides of the Al-Hamra Canal and Al-Maza drain waterways; and on both sides of the paved road to the north and west of the main residential area.

- The residential area reached 278.2 acres with an average annual settlement growth rate of 21.3 percent. This major shift in the area and image of distribution and spread of settlement within the administrative boundaries of the village is attributable to the same circumstances outlined in the prior village over the same period.

- The absence of commitment to avoid the extension towards the archaeological area and its surroundings was noticed during that period, as the residential area grew for the first time towards the west and south to coalesce with the boundaries of the archaeological mound, and the commitment was also absent from the side of the cemetery, which also grew towards the north for the first time to reach the fringes of the archaeological mound, and its area increased by 1.44 acres from the end of the previous period.

-It was also observed that the villagers constructed tombs within the boundaries of the archaeological region, and the Monuments Authority issued forty-seven reports documenting these violations (Maqbool, 2013).

- The archaeological mound area was neglected, and it needs to be well protected.

5) Determining spatial variables to classify maps of the study region based on the probability of existence of monuments

An attempt to identify the change in rural built-up areas over time was followed by an attempt to find a set of variables through which the maps of the study area can be classified according to the degree of probability of the existence of monuments, with a numerical value assigned to each variable that increases with the increase in the probability of the existence of monuments. Figure (12)

5.1) The following factors must be considered while providing numerical values for the variables:

5.1.1) Giving the maximum numerical number comparable to a percentage of 100 percent for the previously mentioned regions, which are geographically determined on the research area's maps as they are archaeological regions.

5.1.2) The likelihood of discovering monuments beneath the regions increases as the age of the built-up regions increases.

5.1.3) Increasing the likelihood of discovering monuments beneath regions constructed with mud bricks in the old nucleus or nuclei that have not been replaced via destruction and re-construction with reinforced concrete.

5.1.4) The reduced likelihood of discovering monuments beneath reinforced concrete construction outside the boundaries of the historic nucleus or nuclei within the village boundaries.

5.1.5) Going closer to sites where monuments have previously been discovered beneath increases the likelihood of discovering monuments.

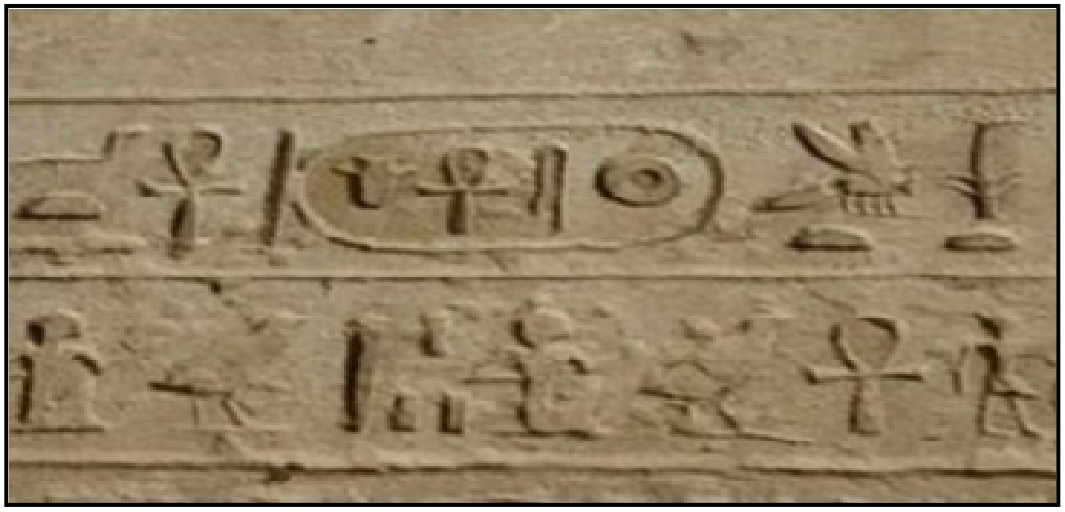
5.1.6) Converting the numerical values of the polygons or spatial data in the various layers, which represent all variables, into percentages attributed to the highest number, which represents the archaeological regions on the maps.

5.1.7) Performing maps classification as a consequence of aggregating the numerical values of all polygons in all data layers Table 3, Keeping in mind that the factors provided were established not only from the standpoint of the study, but also from the criteria used in archaeology (Cable, 2012, p.10).

5.1.8) The inner old nucleus is intended to be the area within the (oldest) built-up region bounded by the inner circular street, while the middle old nucleus urbanism represents the built-up area located between the end of the inner nucleus boundaries and the middle ring street boundaries, and the outer old core represents the area located between the middle ring street boundaries and the outer nucleus boundaries. Located from the end of the middle ring street's boundaries to the end of the outer ring street's borders, which marks the end of

the whole old nuclei area's limits, and the three nuclei are closer to the artificial mound's borders (figure 9). The settlement texture of the historic rural nucleus represents the agglomerated settlement pattern that existed previously in floodplains for security and defense reasons, as well as environmental, social, and economic ones (Liu et al.2020).

5.1.9) Through Geographic Information Systems, buffer zones surrounding the artefact discovered sites have been created, taking into account that the value of the inner buffer zone up to 200 meters from the site of the artefact is higher than the outer buffer zone extending from 200 meters to 400 meters, and the buffer zones were added as variables and layers with vector spatial data. As shown in Figures 9, and 10.



***Source**: An artifact was found In the streets of Banawit (Abdel Radi, 2013).*

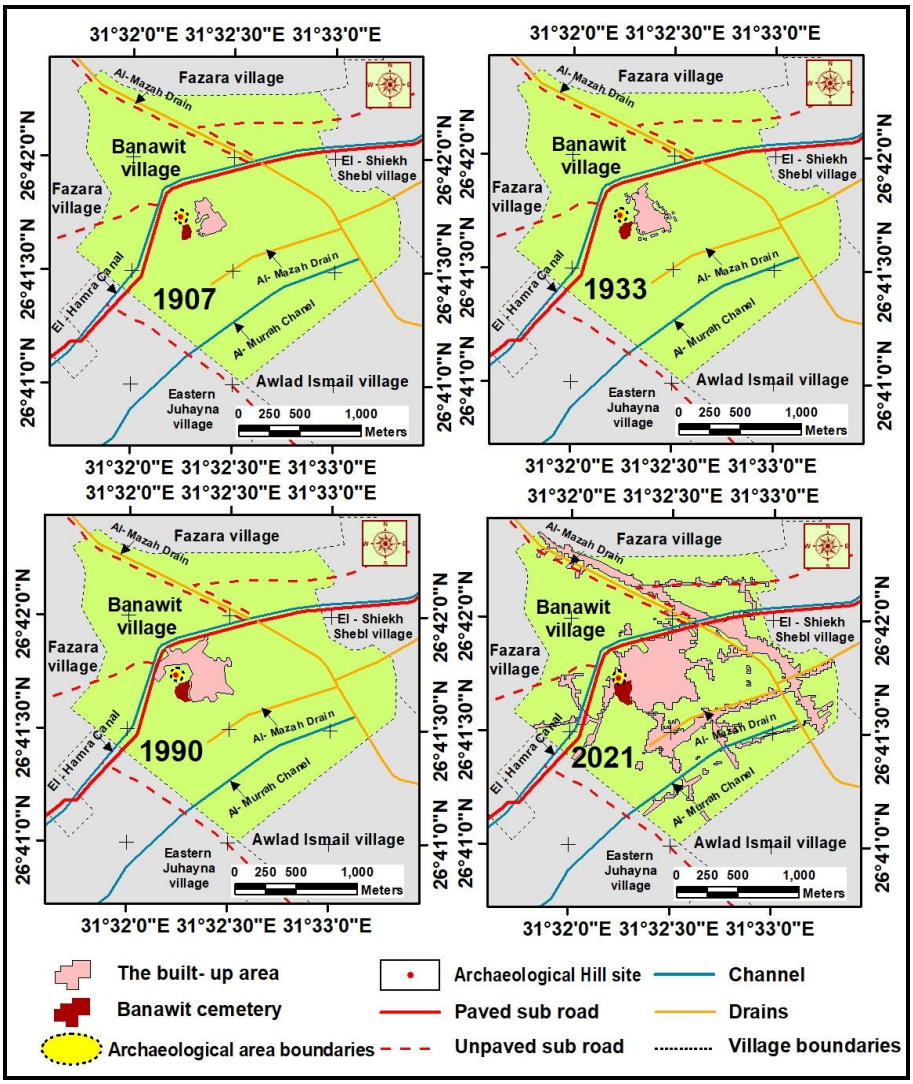
Photo 10. Pharaonic painting discovered when excavating The foundation of the school in Banawit village

Source: *field study, January, 10, 2021 AD.*

Photo 11. The school wall where the pharaonic painting was discovered.

Source: *field study, January, 10, 2021 AD.*

Photo12. Encroachment of the archaeological mound in Banawit village.



Source: *By the researcher, via the Arc GIS program. V.10.7.1, and Erdas imagine.v.9.2 software, based on:*

1- The General Survey of Egypt, Topographic Map, Scale 1: 50000, Maraga Plate, No. 3-17, S.E., Cairo 1907.

2-Survey Department, Map of the Topographical Project of Egypt, Scale 1: 25000, plate EL-Swaama Gharab, No. 44/660, Cairo, 1933.

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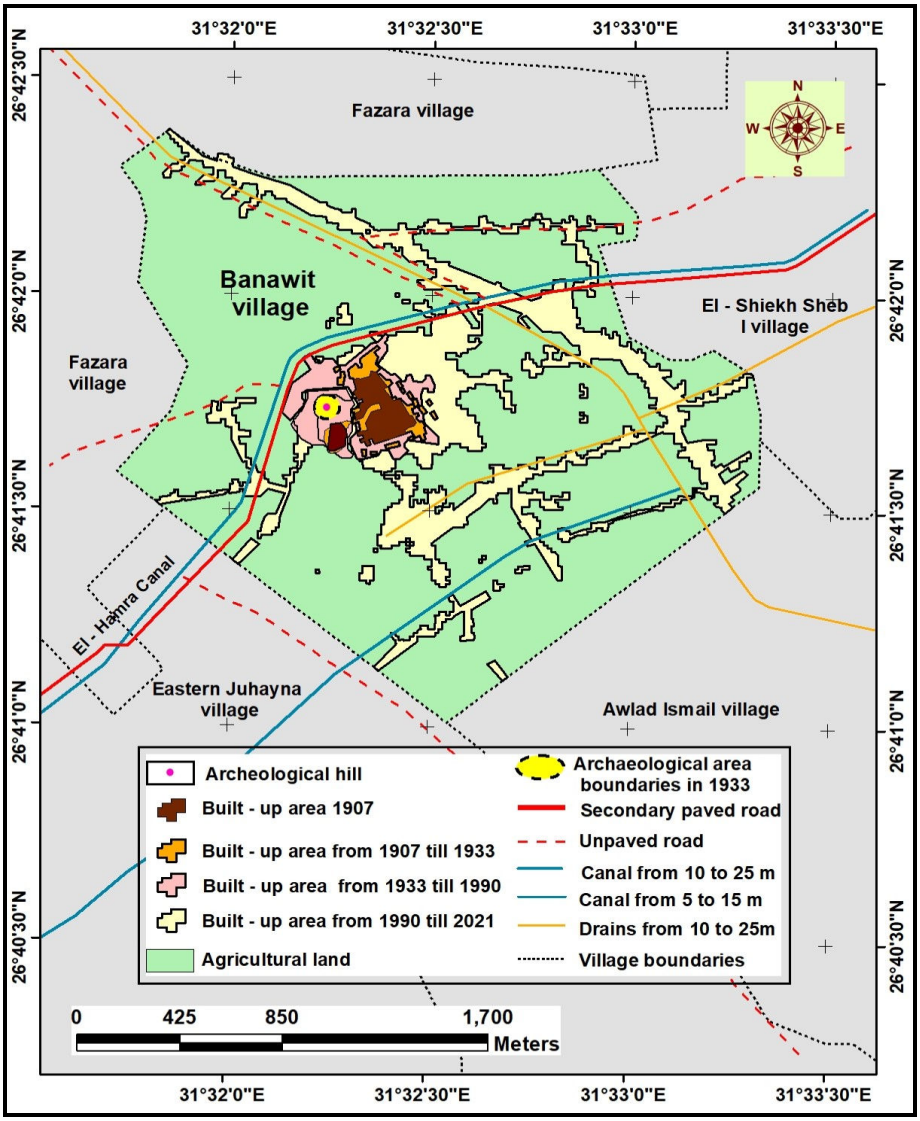
4- Survey Department, Map of the Topographical Egypt Project, Scale 1: 25000, plate EL- Maragha, No. 44/676, Cairo, 1933.

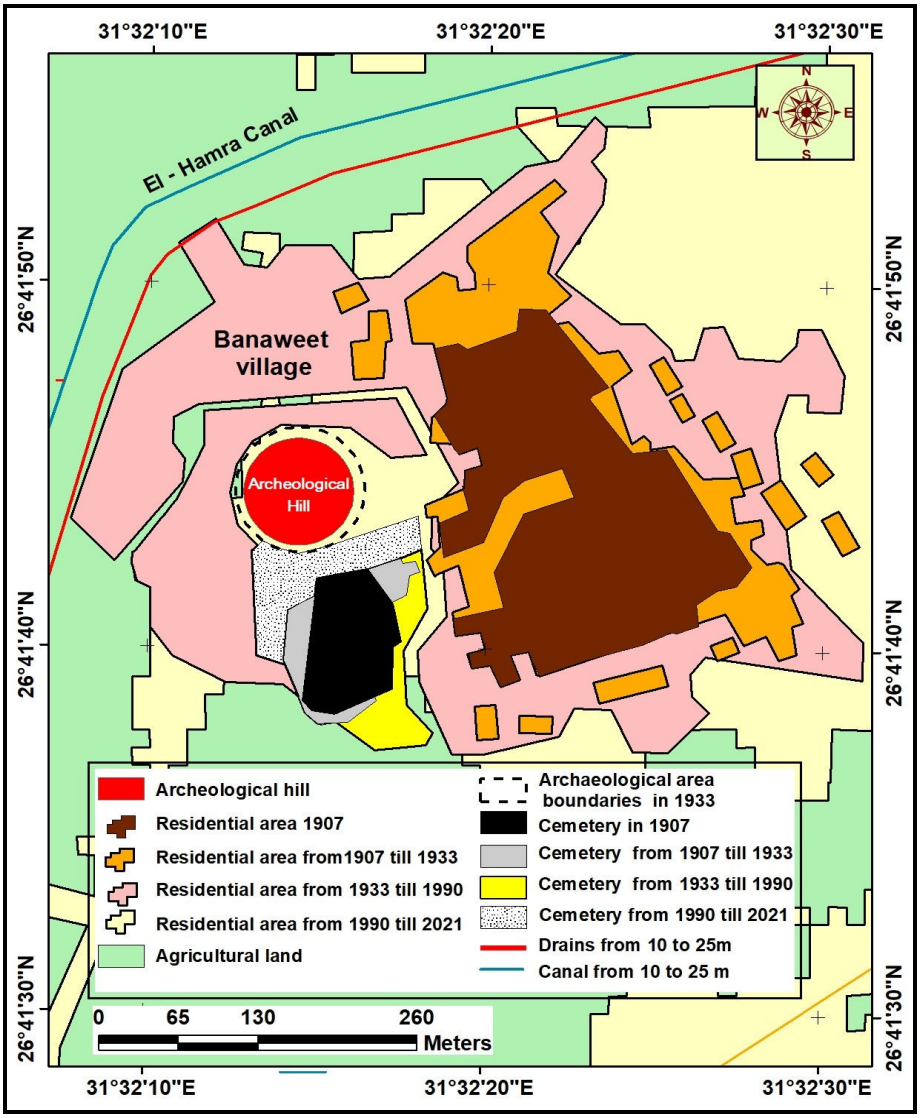
5- Landsat 8 satellite imager (OLI), July, 2021, 24, Path 176, Row41.

Figure 6.Stages of changing the built-up Area in Banawit village 1907:2021.



***Source**: By the researcher, via the Arc GIS program. V.10.7.1, and Erdas imagine.v.9.2 software, based on:*
The same satellite image and maps are used in the previous figure.

Figure 7.The growth of the built-up area of the village of Banawit 1907-2021 AD.



***Source**: By the researcher, via the Arc GIS program. V.10.7.1, and Erdas imagine.v.9.2 software, based on:*
The same satellite image and maps are used in the previous figure.

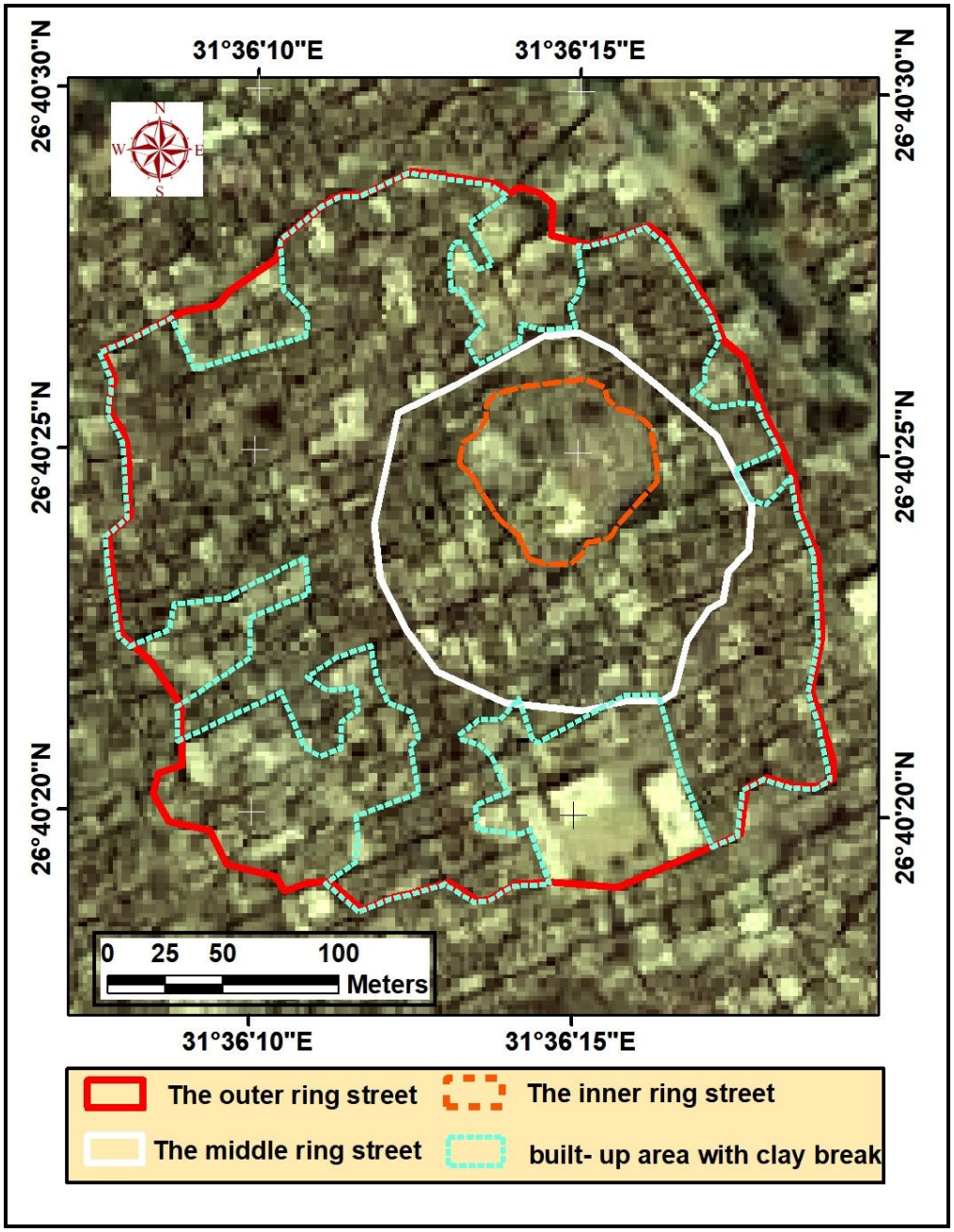
Figure 8. Rural built-up areas and cemeteries expanding on the archaeological area in Banawit village, 1907-2021 AD.

Table 3. Variables for classifying the research area maps based on the likelihood of the existence of monuments in 2021 AD.

Variables		The polygons or pixels numerical value
The archaeological region that was defined on maps of the research area by spatial identification (The most significant numerical value)		**15**
The geographic space of the old nucleus or nuclei in the rural built-up region. **It is characterized by the circular street limits that encircle the previous nucleus or nuclei.**	The historic nucleus's inner built-up region.	**8**
	The historic nucleus's middle built-up region.	**7**
	The historic nucleus's external built-up region.	**6**
Sites where people discovered monuments.	The inner buffer zone around the site where the monuments were discovered, up to 200 m from the spot where the monuments were discovered (higher numerical value).	**+4**
	The outer buffer zone around the site where the monuments were discovered, from 200m to 400m from the spot where the monuments were discovered (lower numerical value)	**+3**
Areas within the historic nucleus that are still made of mud bricks, as determined by the street grid pattern (have greater numerical value).		**+2**
The areas inside the old nucleus that have been replaced, renovated, and reconstructed with reinforced concrete (a lower numerical value), but the sum of the layers' values will be relatively high.		**-1**
Outside the boundaries of the old nucleus or nuclei, areas constructed with reinforced concrete (Lower numerical value).		**4**
Agricultural land within the boundaries of the study area (a numerical value that is relatively higher than the previous variable).		5

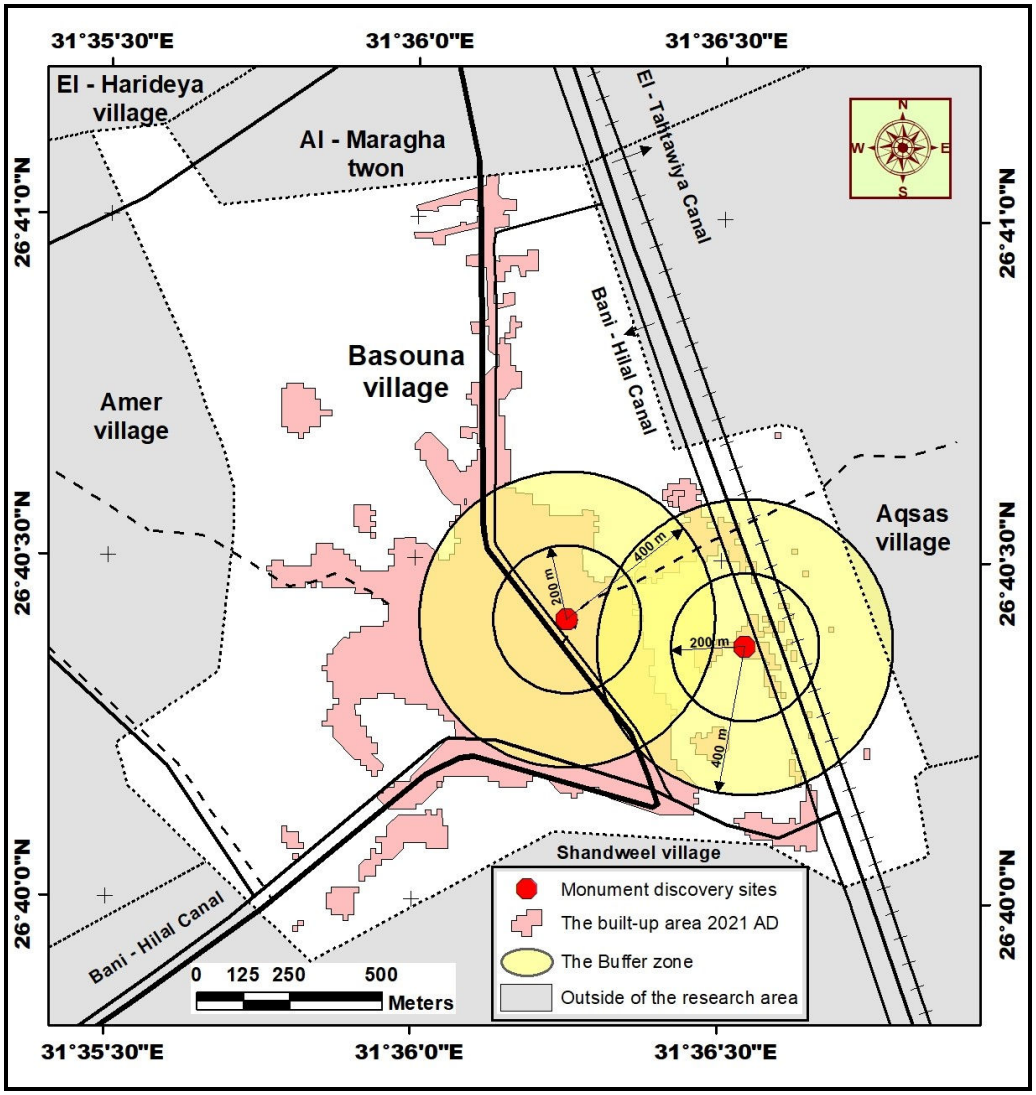
Source: *Suggestions designed and calculated by the author via the Arc GIS program. V.10.7.1.*

** Numbers with a minus or plus signify that it is an added spatial data layer.*



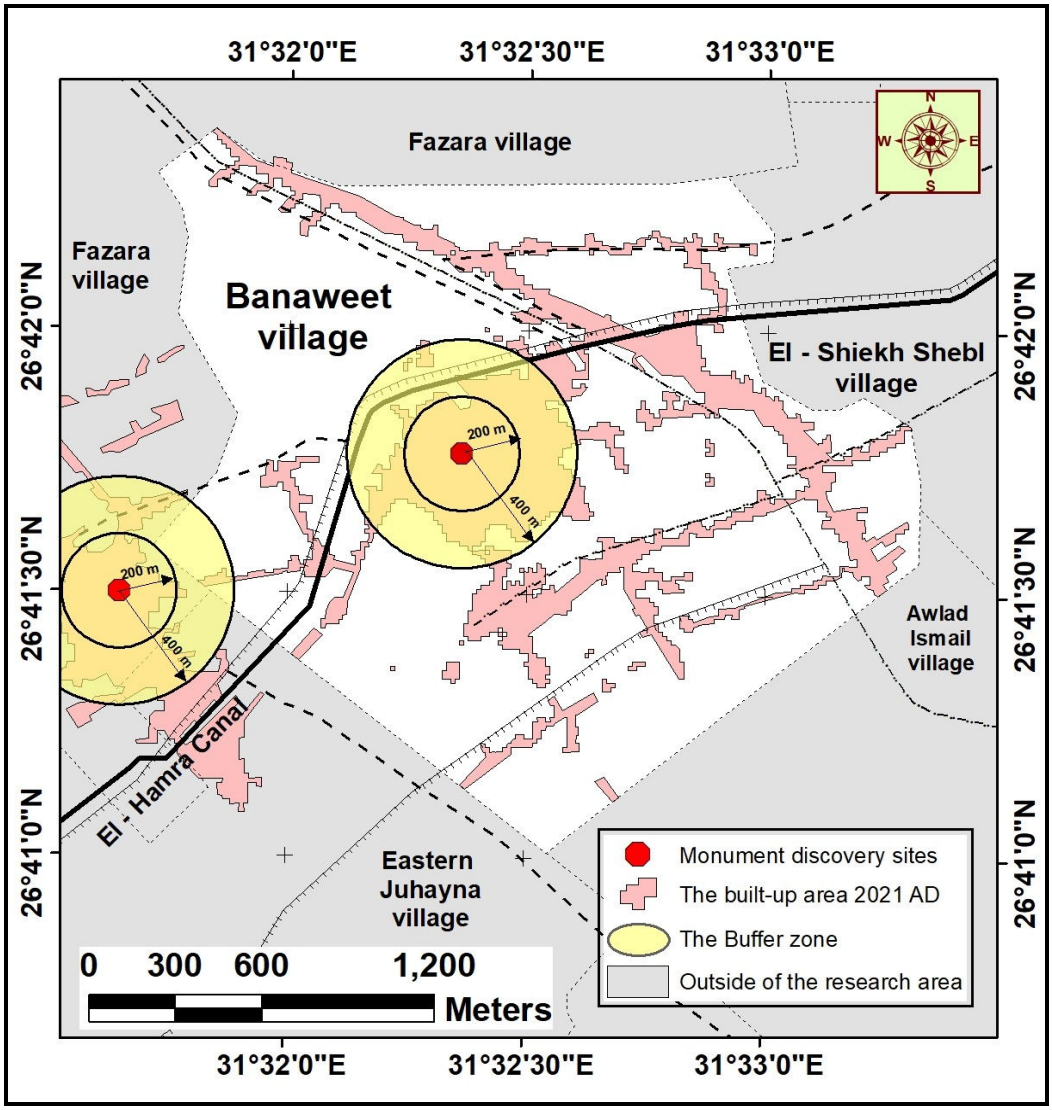
***Source**: By the researcher, via the Arc GIS program.V.10.7.1, based on: Google Earth, 2021.*

Figure 9.Circular streets (inner, middle, and outer), and the built-up area of Bassouna village with mud bricks And reinforced concrete within the historic nucleus.



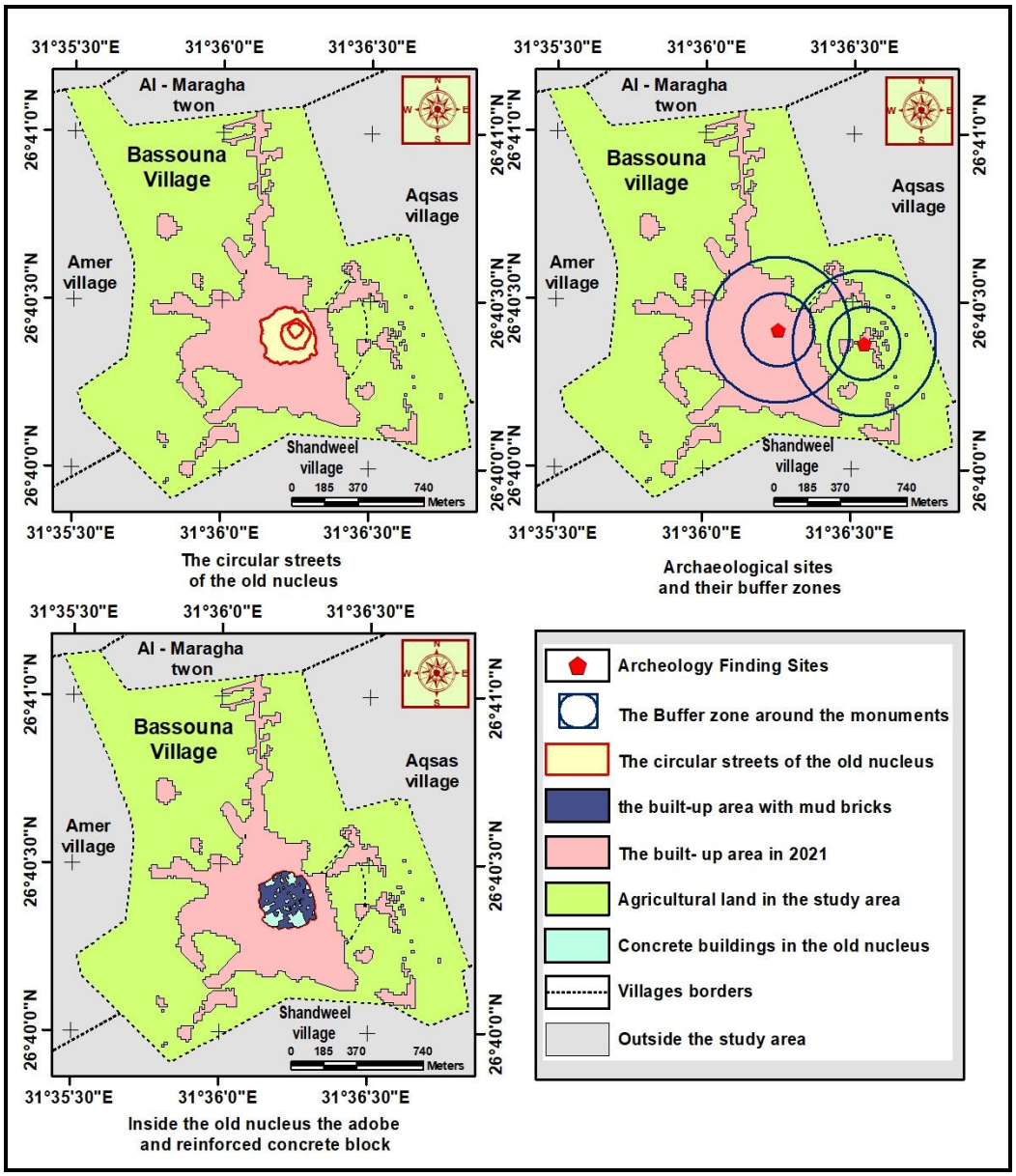
***Source**: By the researcher, via the Arc GIS program. V.10.7.1, and Erdas imagine.v.9.2 software, based on:* The same satellite image and maps are used in figure 4.

Figure 10.The buffer zones around the discovered Monument sites in Bassouna village.



Source: *By the researcher, based on: The same satellite image and maps are used in figure 6.*

Figure11. The buffer zones around the discovered Monument sites in Banawit village



***Source**: By the researcher, based on:*

1- *The same satellite image and maps are used in figure 4.*
2- *Google Earth, 2021.*

Figure12. The proposed variables for classifying the study Area due to the likelihood of the existence of monuments

6) Post- processing stage:

6.1) Determine the spatial dimensions of all the variables proposed: Taking into account digitizing each variable in a separate spatial data layer, including buffer zones and 2021 built-up areas, as a result of the satellite image hybrid classification process.

6.2) Giving numerical values or weight to all variables, those were digitized in each layer by feeding the attribute data and adding a field containing the variable's numerical value.

6.3) By converting all vector spatial data in all layers to raster data and standardizing pixel size to 1 m2, each pixel will carry the numerical value of the variable in the layer.

6.4) Aggregate all spatial data and attribute values in all layers: It will create maps that represent the classification of the study area based on the degree of probability of finding monuments, based on the numerical values proposed (Figure 14, 16).

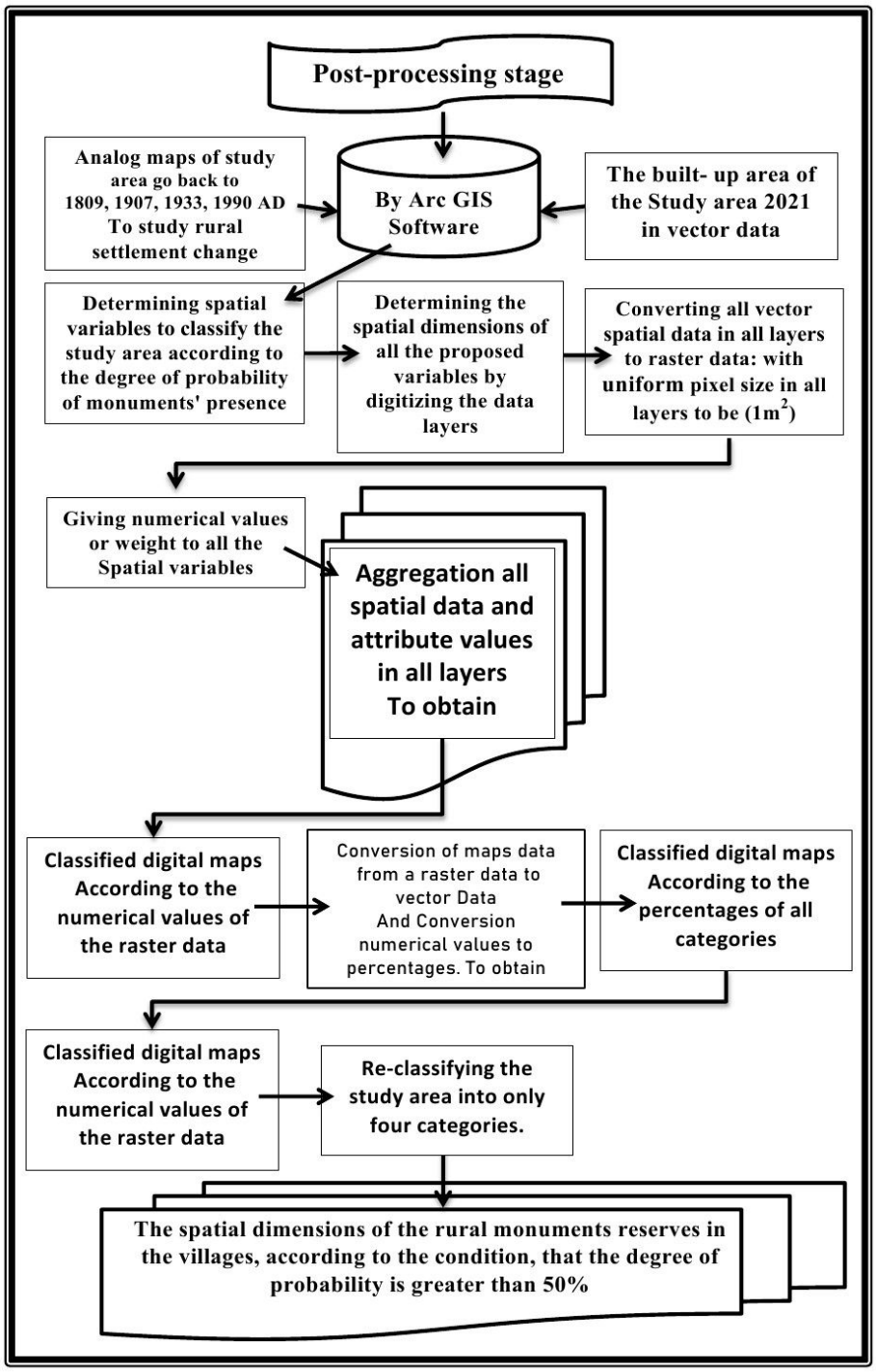
6.5) Converting the map file representing the classification of the study area from raster to vector data.

6.6) Converting numerical values on maps to percentages.

6.7) Create maps that depict the study area's classification based on the percentages of all categories. (Figure 15, 17)

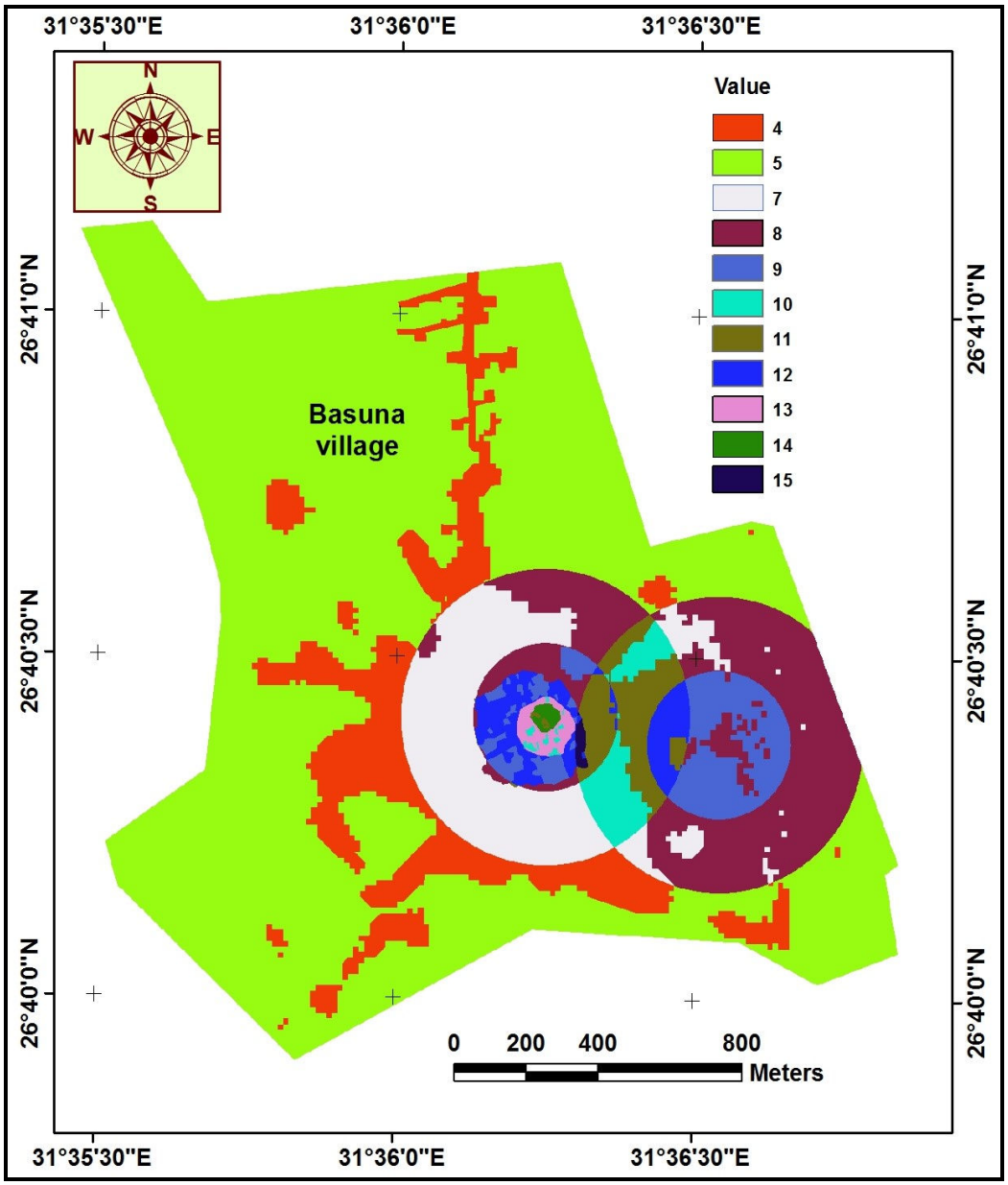
6.8) Reclassifying the study area maps into only four categories based on percentages.

6.9) Producing maps specifying the spatial dimensions of rural monument reserves in the study area's villages, assuming that the likelihood of discovering the monuments is greater than 50%



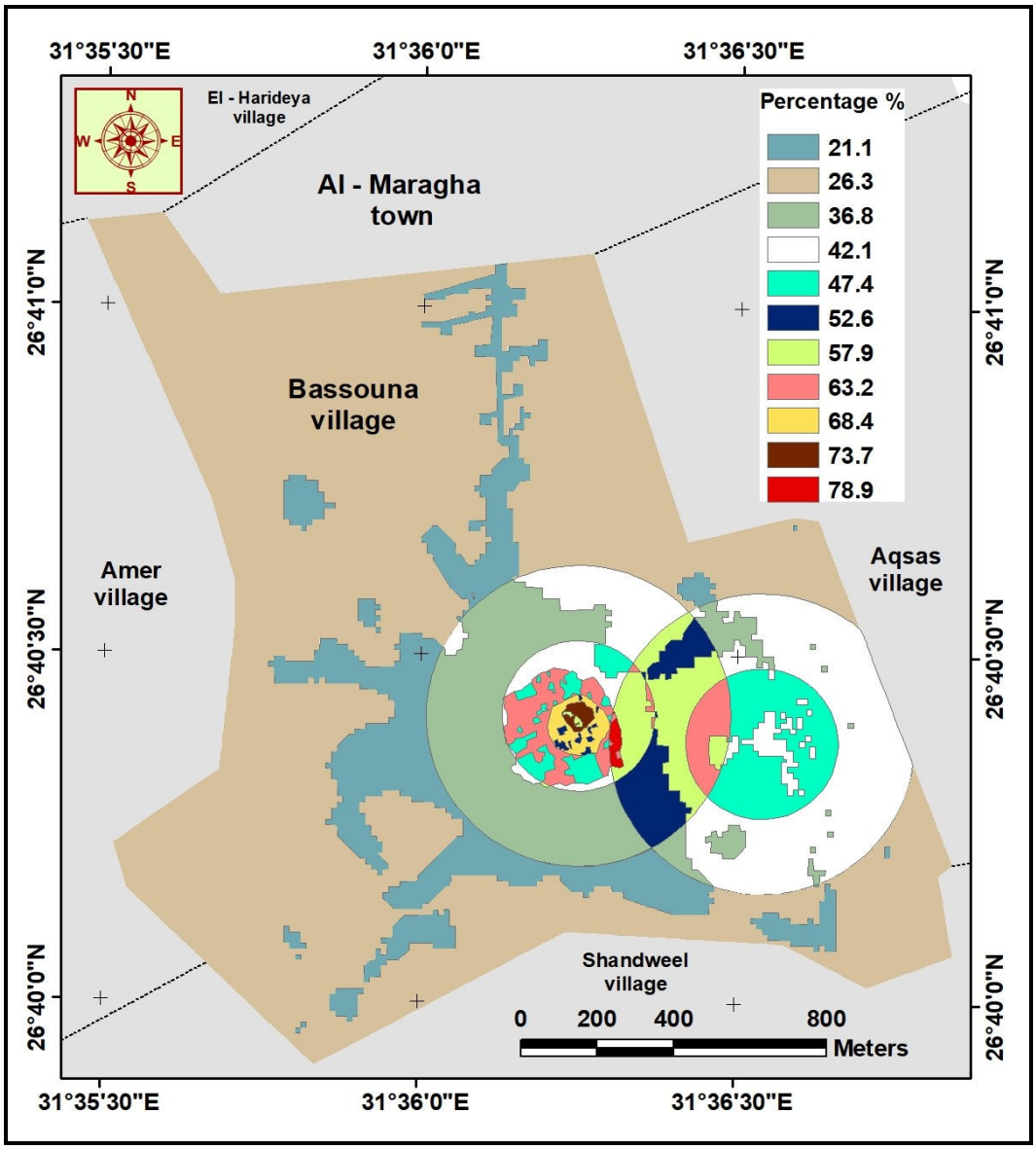
Source: *Researcher design, according to the methodology.*

Figure13. Post-processing stage.



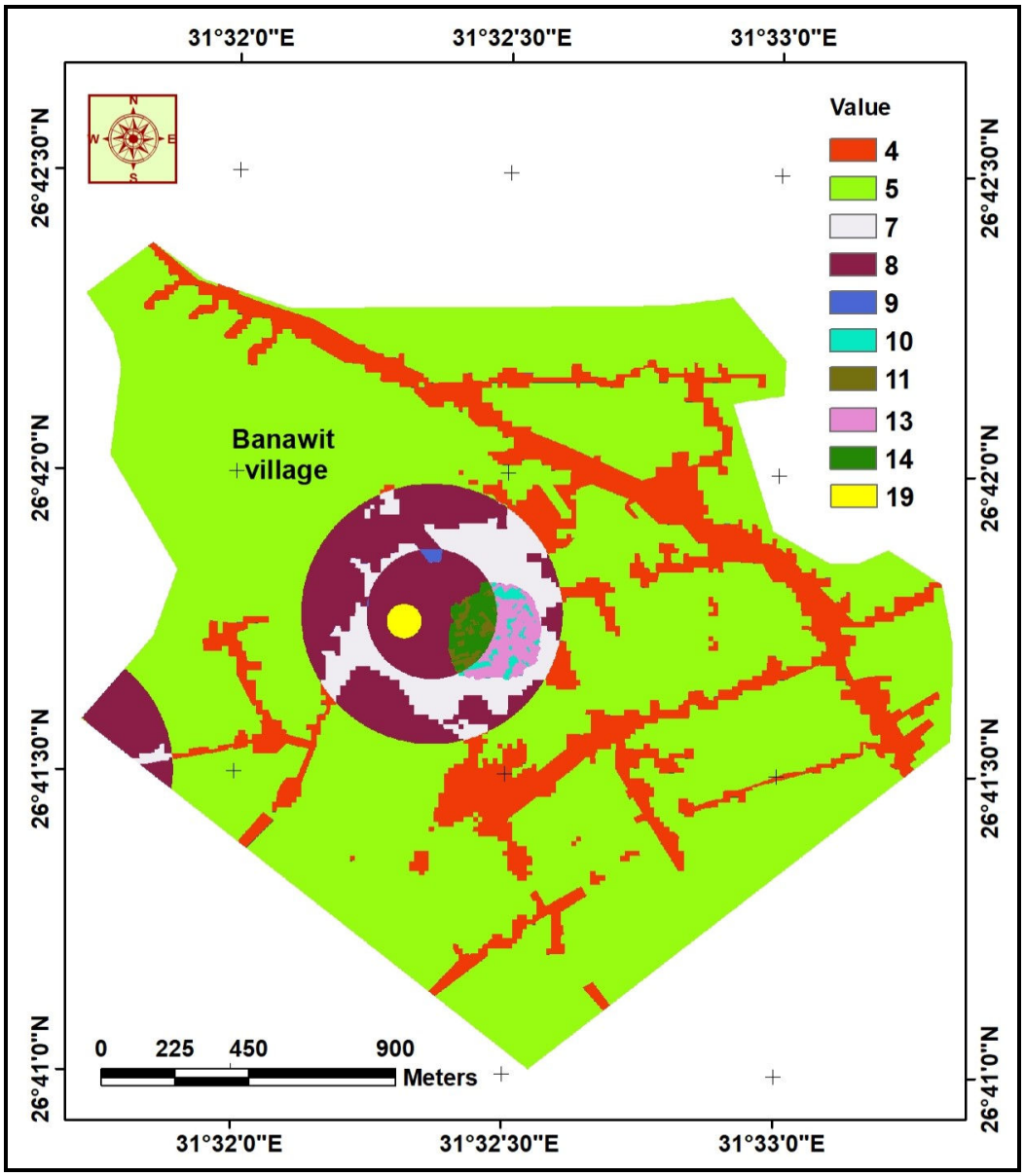
***Source**: By the researcher, based on:*
The same maps and satellite image are used in figure 4.

Figure 14.Bassouna village classification based on the Probability of discovering monuments via the use of Numerical values and raster data in 2021AD.



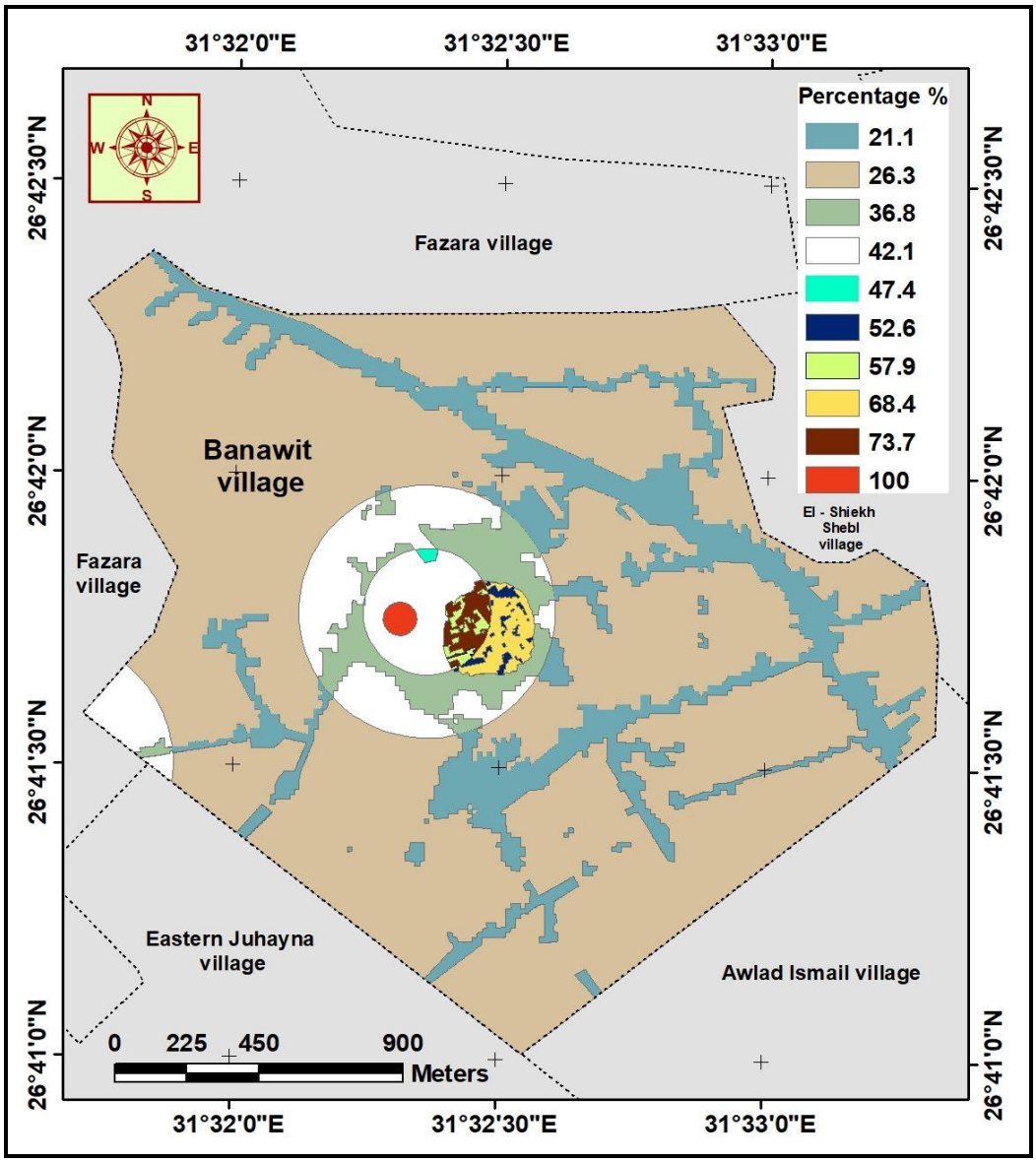
***Source**: By the researcher, based on:*
The same maps and satellite image are used in figure 4.

Figure 15.Bassouna village classification based on the Probability of discovering monuments via the use of Numerical values and vector data in 2021AD.



***Source**: By the researcher, based on:*
The same maps and the satellite image are used in figure 6.

Figure 16.Banawit village Classification, according to Probability of the degree of finding monuments, Using numerical values and raster data.



***Source**: By the researcher, based on:*
The same maps and the satellite image are used in figure 6.

Figure 17.Banawit village Classification based on the probability of discovering monuments via the use of Numerical values and vector data in 2021AD.

7) Results:

7.1) Outputs of analysis and interpretation of topological relationships between polygons in informational layers: (Classified maps).

Table4. Classification of Bassouna village within administrative boundaries based on the percentage of monuments that are likely to exist in 2021 AD.

Numerical value for polygon or pixel	probability of finding monuments (%)	The area (Sqm)	probability of finding monuments by category	Area in acres	From the total village's area (%)
4	21.1	349641.2	Low	83.3	11.4
5	26.3	1876704.1	Moderate	604.7	82.4
7	36.8	239002.2			
8	42.1	314935.4			
9	47.4	109014.2			
10	52.6	46380.1	High	44.5	6.1
11	57.9	68828			
12	63.2	55393			
13	68.4	12531.2			
14	73.7	3986.6			
15	78.9	3334.9	Very high	0.8	0.1
TOTAL	---	3079750.9	---	733.3	100

Source: *By the author, via the Arc GIS program. V.10.7.1.*

Table 5. Classification of Banawit village within administrative boundaries based on the percentage of monuments that are likely to exist in 2021 AD.

Numerical value for polygon or pixel	probability of finding monuments (%)	The area (Sqm)	probability of finding artifacts by category	Area in acres	From the total village's area (%)
4	21.1	624325.1	Low	148.6	14.7
5	26.3	3082134.7	Moderate	846.7	83.5
7	36.8	145653.2			
8	42.1	325894.6			
9	47.4	2213.6			
10	52.6	8439.3	High	16.5	1.6
11	57.9	8927.9			
13	68.4	32611.4			
14	73.7	19222.8			
19	100	8717.5	Very high	2	0.2
TOTAL	---	4258140.1	---	1013.8	100

Source*: By the author, via the Arc GIS program. V.10.7.1.*

8) Conclusion:

Tables 4,5 show the classification of the two villages in the study area according to monument existence probability degree, and by comparing the results of the two villages, we conclude the following:

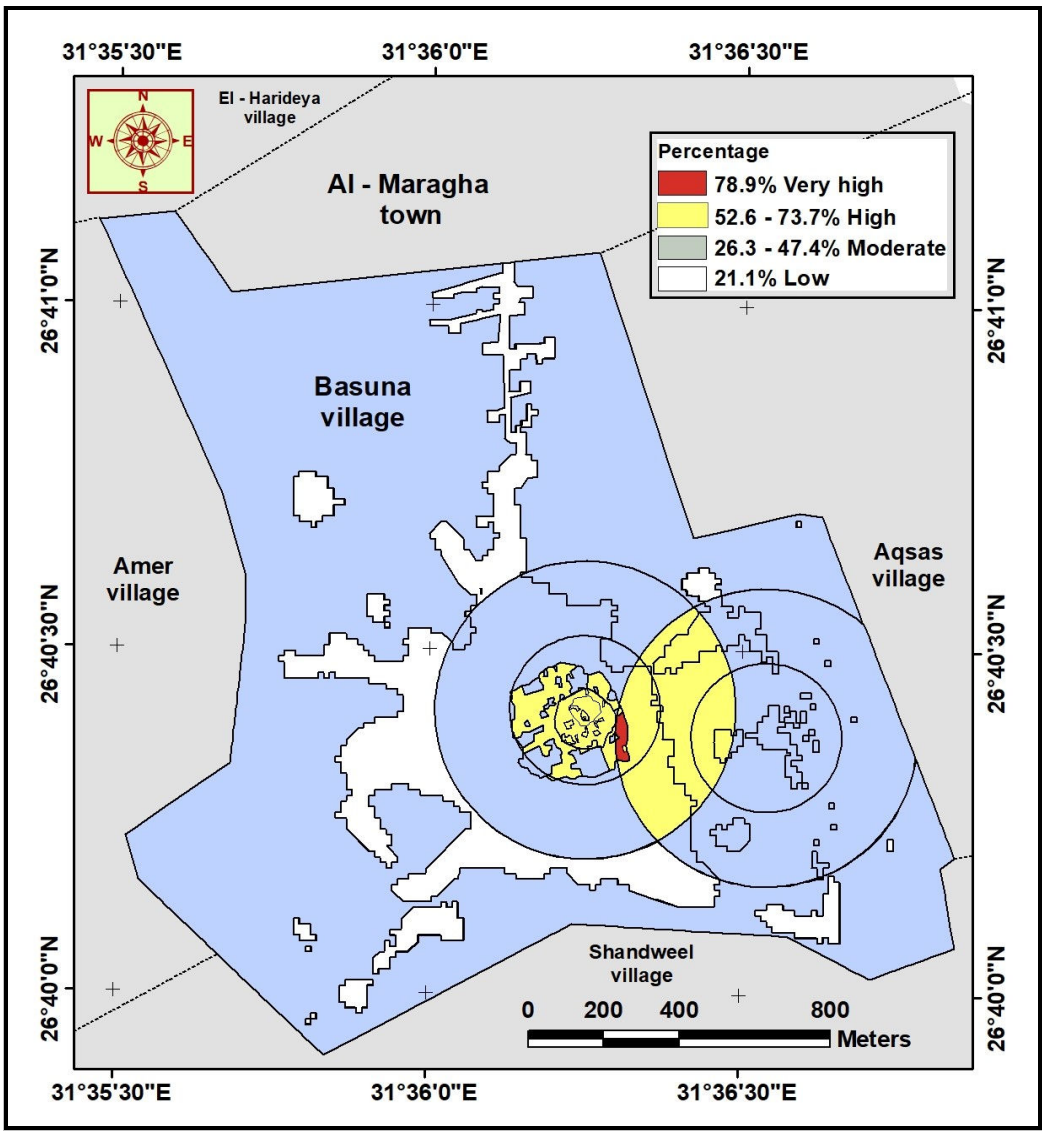
8.1) The category (very high probability) occupied an area of 0.8 acres, representing 0.1 % of the Bassouna village area, which increased to (2) acres, representing 0.2 % of the Banawit village area, for several reasons, the most important of which is the presence of an area indicated on Banawit village maps as an archaeological area.

8.2) The category (high probability) occupied 44.5 acres, or 6.1 % of the area of Bassouna village, which decreased to (16.5) acres, or 1.6 % of the area of Banawit village.

8.3) The category (low probability) occupied an area of 83.3 acres, accounting for 11.4 percent of the area of the village of Bassouna, and increased to occupy an area of 148.6 acres, accounting for 14.7 percent of the area of the village of Banawit. (Figures 18, 19)
Figure 18.19 and the conditions established by the study classify areas with a percentage of 50% or higher as rural monument reserves. As shown below.

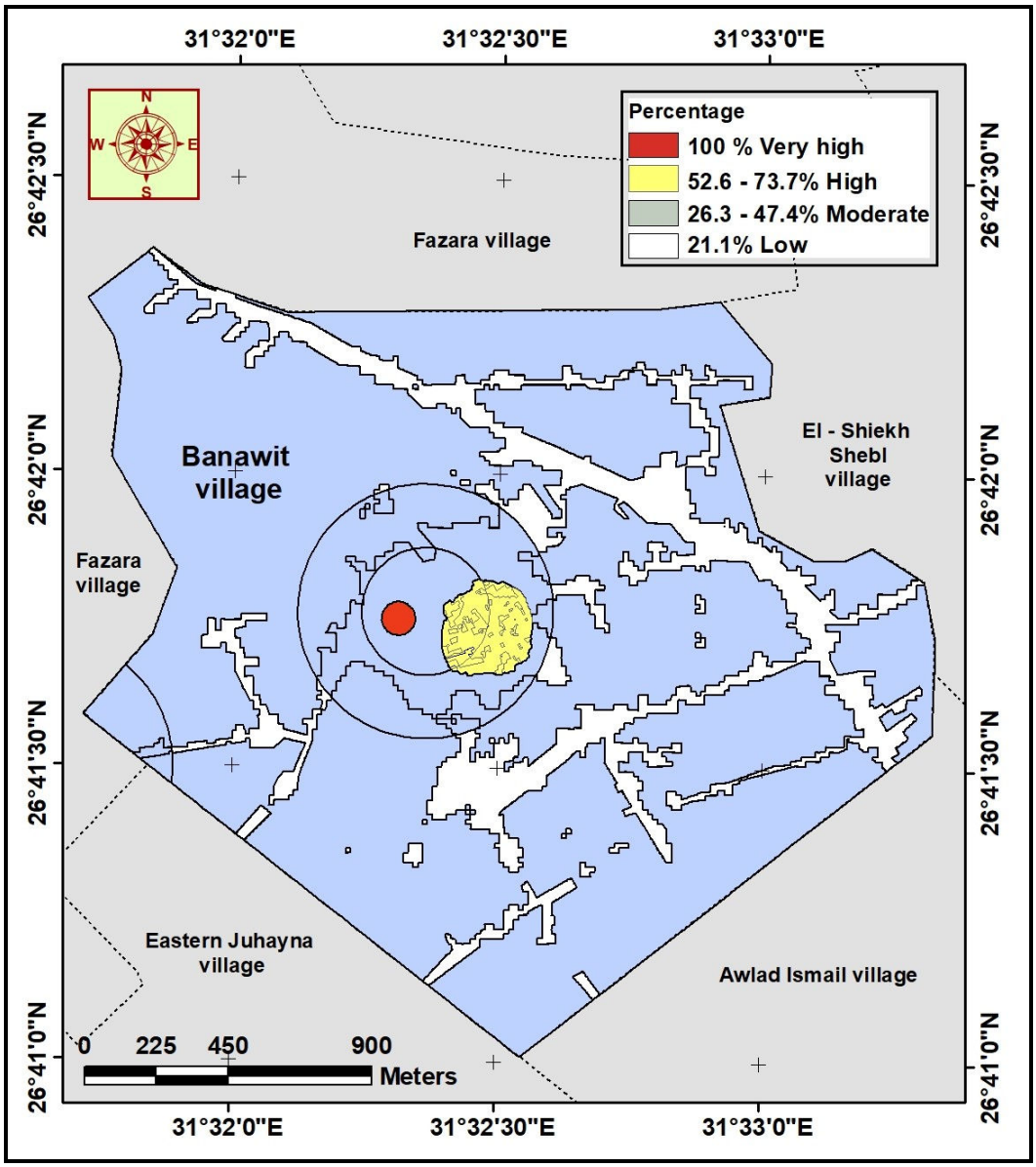
8.4) The proposed monument reserve area in Bassouna village is 45.3 acres, or 6.2 % of the village's total area. (Figure20)
- The proposed area as a monument reserve in Banawit village reached 18.5 acres, at a rate of 1.8% of the total village area.

8.5) Archaeological monuments, due to their age, show a complete lack of connection with current administrative borders (Rzasa and Ciski, 2018) In both villages.



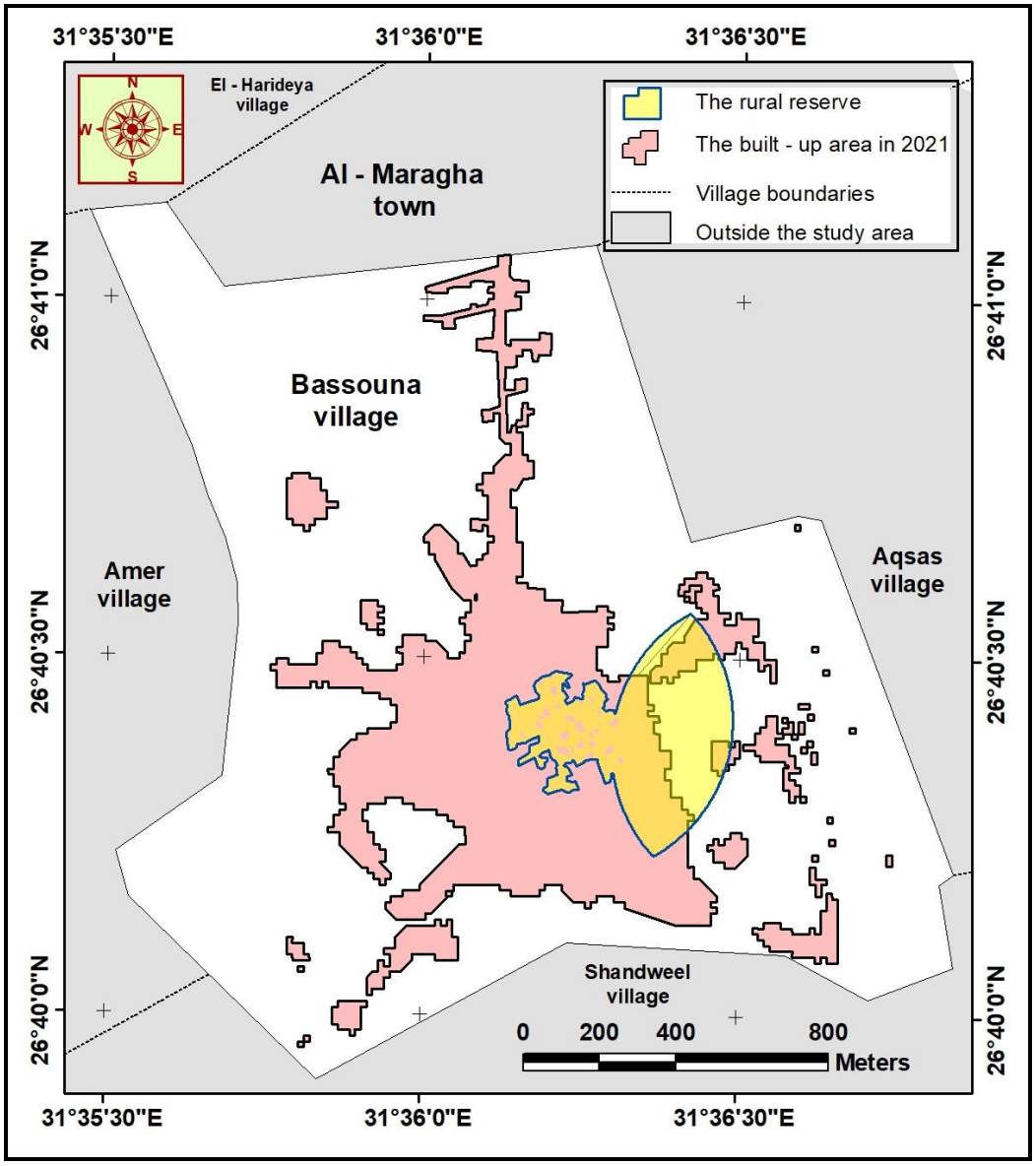
***Source**: By the researcher, based on:*
The same maps and the satellite image are used in figure 4.

Figure 18. A four-category classification of Bassouna Village According To The likelihood of discovering Monuments in 2021 AD.



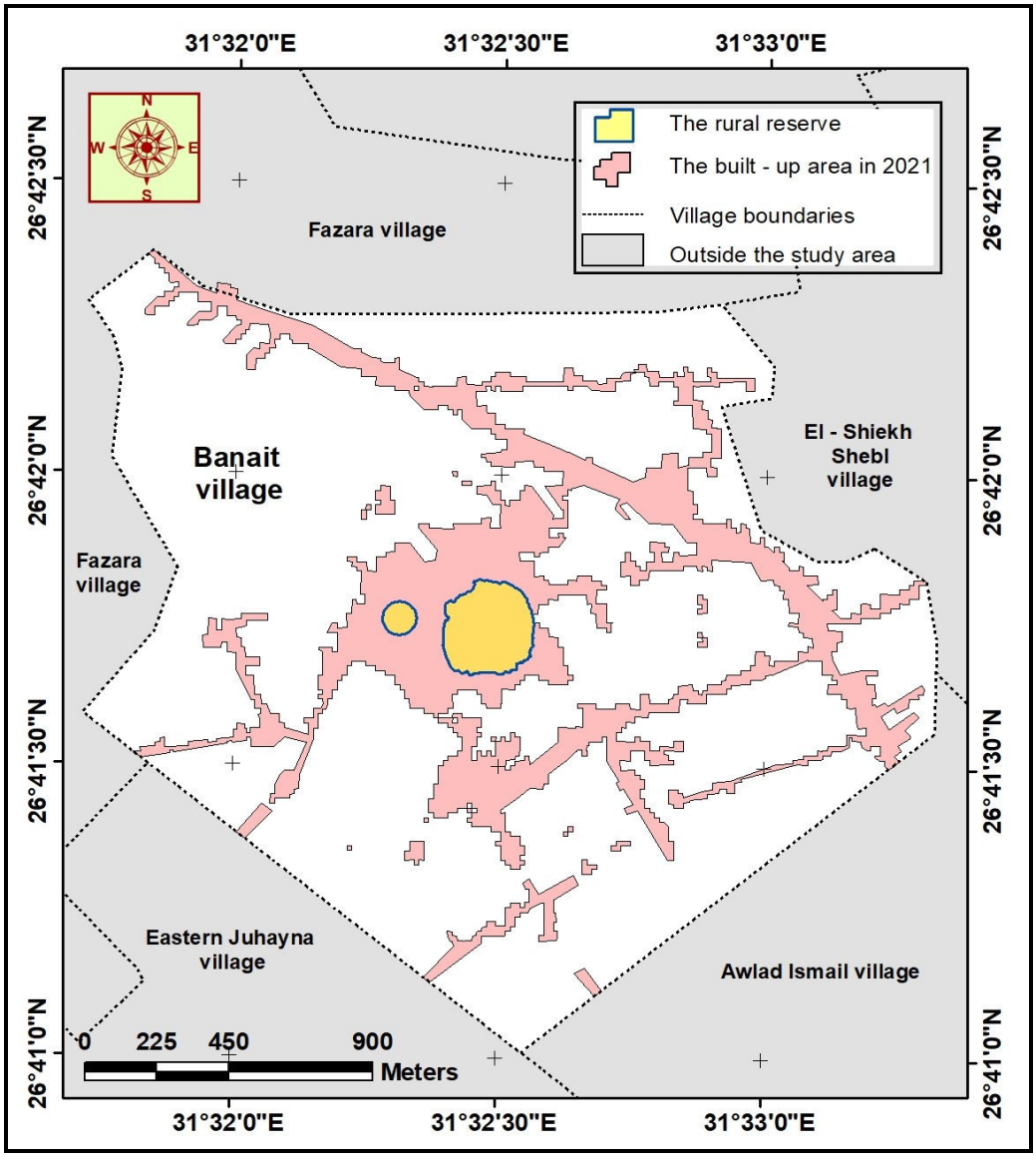
***Source**: By the researcher, based on:*
The same maps and the satellite image are used in figure 6.

Figure .19 A four- category classification of Banawit Village According to the likelihood of discovering Monuments in 2021 AD.



***Source**: By the researcher, based on:*
The same maps and the satellite image are used in figure 4.

Fig 20.The suggested geographical boundaries of a rural Reserve in Bassouna village, 2021 AD.



***Source**: By the researcher, based on:*
The same maps and the satellite image are used in figure 6.

Fig 21.The suggested geographical boundaries of a rural Reserve in Banawit village, 2021 AD.

9) Recommendations:

9.1) Making a tabular database of historical villages that are not on the tourist map in Upper Egypt.

9.2) Using Geographic Information Systems and Remote Sensing to build a spatial and tabular database as a (digital maps) in the form of a cartographic project, the goal is to identify the geographical dimensions of monument reserves in all Upper Egypt historical villages.

9.3) Elimination of neglect in the Banawit village archaeological mound area by fencing, similar to what is happening with Indian archaeological mounds in the United States.

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رسم الخرائط الرقمية للقرى التاريخية كمحميات أثرية، دراسة جغرافية لقريتي باصونة وبناويط، مركز المراغة، محافظة سوهاج، مصر.

Dr. Ismail Ali Ismail Mohamed

Assistant Professor of Human Geography, Department Surveying of Natural Resources in Environmental Systems, Environmental Studies and Research Institute, University of Sadat City.
Ismail.Mohamed@esri.usc.eg

الملخص

تُعنى الدراسة بالقرى القديمة أو (القرى التاريخية في صعيد مصر)، تلك القرى التي نشأت مناطقها العمرانية الريفية قبل الفتح الإسلامي لمصر وكانت موجودة خلال الأسر الفرعونية والعصور التي تلتها (اليونانية والرومانية والقبطية)، وظلت موجوده بمواقعها في العصر الحديث ولا تزال كتلتها العمرانية قائمة حتى الآن، وعلى وجه الخصوص القرى غير المدرجة في الخرائط السياحية، تلك القرى التي تُعاني من الإهمال الشديد للكنوز الأثرية غير المكتشفة و الواقعة تحت مناطقها العمرانية الريفية ومحيطها، وتتعرض للنهب والسرقة، فضلًا عن عدم وجود قواعد البيانات المكانية التي تُمكن من رسم (الخرائط الرقمية الحديثة) التي توضح تصنيف هذه القرى حسب درجة احتمالية وجود الآثار غير المكتشفة. تهدف الدراسة أولاً إلى وضع معايير ومتغيرات معينة يمكن من خلالها تصنيف الاستيطان الريفي لهذه القرى التاريخية ومحيطها – ضمن حدودها الإدارية – حسب إمكانية وجود الآثار غير المكتشفة . ثانيًا: إنشاء ورسم خرائط رقمية لتصنيف العمران والمنطقة المحيطة به ضمن الحدود الإدارية للقرى محل الدراسة، وفقًا لإمكانية وجود آثار غير مكتشفة، بحيث تتضمن الخرائط بعد التصنيف مواقع محددة ذات احتمال مرتفع، واعتبارها (بمثابة محميات ريفية). ومن خلال الخرائط الرقمية التي انتجتها الدراسة، تم تصنيف القريتين محل الدراسة حسب درجة احتمالية وجود الآثار غير المكتشفة ، وبمقارنة نتائج القريتين المستمدة من قواعد البيانات المكانية للخرائط الرقمية : احتلت المناطق المصنفة ضمن الفئة (احتمالية عالية جدًا) مساحة قدرها (٠،٨) فداناً بنسبة مئوية قدرها (٠،١٪) من إجمالي مساحة قرية (باصونة)، ارتفعت إلى (٢) فداناً بنسبة (٠،٢٪) من مساحة قرية (بناويط)، في حين احتلت المناطق المصنفة ضمن الفئة (احتمالية عالية) مساحة قدرها (٤٤،٥) فداناً، أي (٦،١٪) من مساحة قرية (باصونة)، انخفضت إلى (١٦،٥) فداناً بنسبة (١،٦٪) من مساحة قرية (بناويط). ووفقاً للإشتراطات والمتغيرات التي اقترحتها الدراسة بلغت مساحة المحمية المقترحة بقرية باصونة (٤٥،٣) فداناً، بنسبة (٦،٢٪) من إجمالي مساحة القرية في حين بلغت المساحة المقترحة كمحمية أثرية بقرية بناويط (١٨،٥) فداناً بنسبة (١،٨٪) من إجمالي مساحة القرية.

الكلمات المفتاحية: القرى التاريخية – الخرائط الرقمية – المحميات الريفية الأثرية – قرى مركز المراغة.