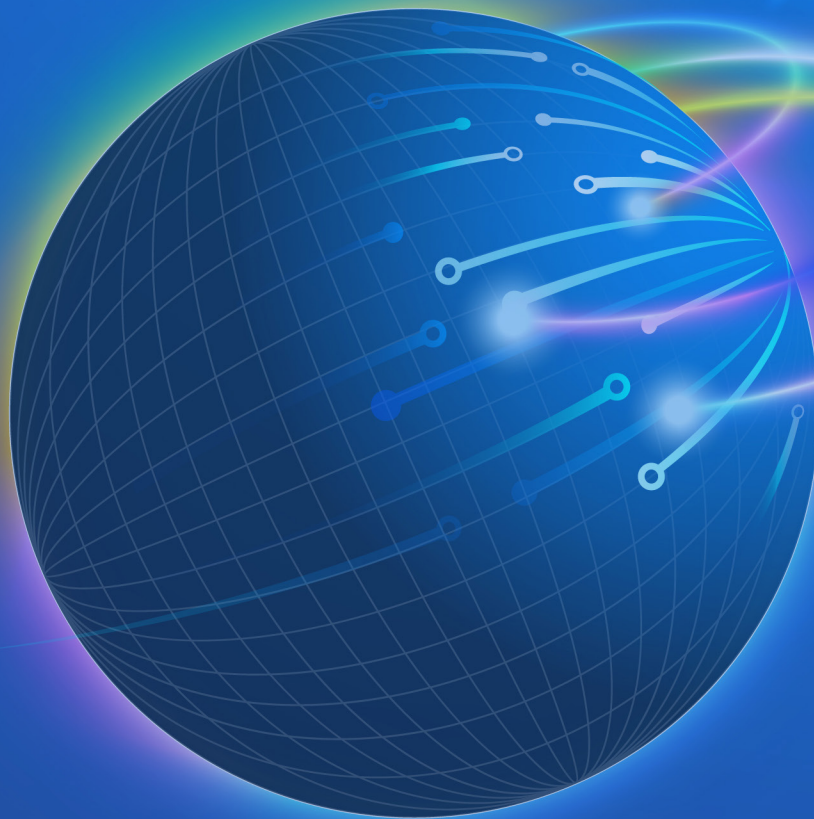




AMERICAN JOURNAL OF **GEOSPATIAL TECHNOLOGY (AJGT)**

ISSN: 2833-8006 (ONLINE)

VOLUME 3 ISSUE 1 (2024)



PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

Geospatial Analysis of Archaeological Sites in Ikara Local Government Area of Kaduna State, Nigeria

Qasim Abubakar Ahmad^{1*}, Nafiu Garba Umar¹

Article Information

Received: March 13, 2024

Accepted: April 06, 2024

Published: April 10, 2024

Keywords

*Archaeologist, Archaeology,
Archaeological Site, Geospatial
Analysis*

ABSTRACT

Ikara Local Government Area of Kaduna State, Nigeria has rich and diverse archaeological heritage. The research employed geospatial technologies, including Geographic Information Systems (GIS) and remote sensing, to analyze and document the archaeological sites in Ikara. The research aims to assess the Geospatial distribution of Archaeological sites in the study area by mapping to locate the Archaeological sites in the study area, determine the pattern of distribution of the Archaeological sites and examine the finds and features in the sites. The research employed a mixed-method approach that combines field surveys, archival research, and geospatial analysis. The research findings show fifteen (15) archaeological sites dispersedly distributed across the Eight (8) wards in the study area with Ikara ward having the highest number of archaeological sites. Also, the dominant cultural materials across the sites are finds in forms of potsherds and features in form of House foundation. The cultural remains on the Archaeological sites are House foundations, mounds, granary, potsherds, iron slag, open grave, stone tools and grinding stones. Based on the findings, dispersed pattern of the Archaeological sites in the study area was deduced from the data collected especially at the southern part of the area of study where the sites are found to be most concentrated. Base on the research findings, it is recommended that further research shall be undertaken using GIS and Remote Sensing Technology for effective Archaeological site discovery, management and preservation.

INTRODUCTION

Archaeology is the study of ancient human behavior based on surviving material evidence or remains of the past (Fagan, 2000). It is seen as an earth science which investigates finds and sites; also, it is a social science that deals with all aspects of human past (Sutton, 2000). Archaeologists mainly reconstruct, describe and interpret past human behavior and cultural pattern through material remains. This is after applying the systematic archaeological research techniques of site discovery through reconnaissance or oral tradition, reconnaissance survey or ethnographic study of the site, classification and analysis of the finds and features discovered, excavation, if necessary, interpretation of the remains discovered and finally, the documentation of the site (Kottak, 2000).

Archaeological sites are locations where the evidence of the past has been buried and preserved (Sutton, 2000). It is also described as a location where the material remains of human activity have been preserved in a way that Archaeologists or Paleo- anthropologists can recover them (Sutton, 2000). A 'Site' or precisely an Archaeological site is any kind of place, large or small, where there are traces of human occupation or his activity found available (Kottak, 2000). According to the author, Archaeological sites consist essentially of activity areas that comprise material cultural objects like tools and remains of food in the form of rubbish dump (Kottak, 2000). Sites do not remain intact rather they change in course of time either through repeated occupation of

man and due to impact of various natural agencies. They however remain intact on many occasions after the site is discarded and abandoned.

Archaeological sites are discovered either accidentally or systematically through aerial photography, old maps, oral tradition, reconnaissance/ pedestrian survey, remote sensing or excavations and artifacts, Ecofacts, fossils, and features are recovered from sites through excavation (Sutton, 2000). Archaeological sites also offer a tangible link to the history, values, culture, and traditions of the Indigenous peoples of the study area (Gadzala, 2014).

Archaeological sites and remains are the subject matter of reconnaissance (Grant, Coring and Flaming, 2008). Archaeologists use a wide range of reconnaissance techniques to locate Archaeological sites and to investigate sites without excavating them' (Grant, Coring and Flaming, 2008). Remains on Archaeological site surface can provide information about the life ways of the past inhabitants of an area and help in reconstructing socio-cultural and economic life ways of the past inhabitants of a site (Sutton, 2000).

Numerous causative processes including erosion, social organization, resource procurement, mining, development projects, length of occupation, and activity loci affect the formation of an archaeological site and its material assemblage (Rossignol, 1992). Traditional survey tools used in finding and recording sites are taken from land survey. Archaeological surveyors initially used compasses, tape measures, stadium rods, and various other survey

¹ Department of Geography and Environmental Management, Faculty of Physical Sciences, Ahmadu Bello University, Zaria, Nigeria
^{*} Corresponding author's e-mail: qasimabubakarahmad@gmail.com

tools. However, now employ electronic devices such as Total Stations and Global Positioning System (GPS) units to help them map an area or site (American Institute of Archaeology, n. d)

During the last decades, many countries realized the need for reliable and up-to date information about the earth, the society and the environment which could not be fulfilled with the conventional ways of collecting, recording, updating and processing data. Thus, the use of Geographical Information Systems (GIS) or Land Information Systems (LIS) came into an exceptionally big development specifically from the beginning of '80s (Tokmakidis *et al.*, 2004).

Archaeologists have made great use of GIS to discover ancient sites, artifacts and issues such as analyzing known locations and predicting unknown locations sites. Archaeological data used include Archaeological sites, geographical areas, historical antiquities, number of antiques found about genetic data such as elevation, slope, topography, prediction of geographic location and new Archaeological sites (Gaydarska, 2014).

Archaeologists over the years have been making attempts to document Archaeological sites and their location using their systematic methods and techniques of inquiry like reconnaissance survey, oral tradition, written records, ethnographic studies and excavations but the methodologies adopted are slow, destructive and time consuming and therefore, could not locate properly the distribution of a reasonable number of Archaeological sites accurately within a specific time frame and the methodologies have always led to further destruction of some finds and features on the sites especially during excavation. With the advent of modern technologies like the use of Remote sensing and Geographic Information Systems, attention of Archaeologist and cultural resources managers has been shifted to the adoption and use of this tool to carry out sites locations and surveys, site mapping, landscape analysis, cluster analysis of sites and intra sites analysis. This necessitates undertaking research using modern technology and techniques like GIS to study, analyze and document the locations and the spatial distribution of Archaeological sites in this area using Remote sensing and GIS techniques so as to reveal the potentials and richness of the areas in cultural materials. This will expose the potentiality of the area's rich culture history which will not only contribute knowledge to the existing literatures but to the body of knowledge as a whole.

The African continent, West African region and Nigeria has long records of human evolution and habitation and therefore, have reasonable number of Archaeological sites but unfortunately, do not embrace much use of modern technology in the Archaeological site research, management, preservation and documentation (Barham *et al.*, 2008).

In Situ, observations are used in cultural heritage and Archaeological sites mapping (Felix, 2018). However, this procedure requires periodic observations which

are practically difficult to combine with traditional methods and practices since this is time consuming and expensive thus, modern technologies mainly GIS and remote sensing are been used as tools for prediction at the Archaeological sites (Felix, 2018). Archaeological surveys in West Africa and Nigeria were executed mainly in coastal and hinterland regions, Thus, the analysis of cultural heritage in the region has been geographically restricted and lacking in regional dynamics (Faleye, 2016) In adopting spatial approach, the aim has been to explore the dynamic past of the region's history through material remains, writings, and oral tradition (Faleye, 2016).

Nigeria is a country endowed with a lot of cultural heritages sourced from its multi-cultural communities. Contemporary status of most Nigerian cultural heritages and Archaeological sites (both material and non-material) is best described as endangered (Onyima, 2016). It is endowed with 'about 29 game reserves, 1129 forest reserves, 4 game sanctuaries, 2 strict nature reserves and 8 national parks' (Marguba, 2008). The preservation of Nigerian cultural heritages is inarguably threatened by human activities, natural forces, biological and chemical agents among others (Okpoko, 2011; Ogundele, 2014). However, the little successes made over the years in the preservation of Nigerian cultural heritages has been attributed to conscious systematic and scientific efforts and researches conducted by professionals in the disciplines of archaeology, cultural anthropology, linguistics, ethnography, palynology, paleontology, geology, geography, museum studies, among other cultural resource managers (Onwuka, 2002; Ogundele, 2014).

Nigerian cultural heritages and Archaeological sites are faced with a lot of challenges such as the influence of modernization, Christianity, Commerce, Civilization, Change, Development, Looting, and antiquarians among others (Oguyemi, 2002). Apart from smuggling, theft, vandalism and looting of museums, another most threatening challenge facing Nigerian Archaeological sites and our cultural heritage is religious dogmatism and iconoclasm (Oguyemi, 2002). Ikara Local Government Area (LGA) in Kaduna State, Nigeria, sits at the crossroads of rich cultural heritage and pressing challenges. The area boasts numerous archaeological sites that hold immense potential for understanding the region's past, shedding light on pre-colonial settlements, migration patterns, and socio-economic development. However, these sites face a multitude of threats, hindering their research potential and jeopardizing their preservation for future generations. Reasonable numbers of Archaeological sites at different wards containing different cultural materials were discovered in the area. Given these threats, the research problem lies in the absence of comprehensive geospatial analysis and documentation of archaeological sites in Ikara LGA. This lack of knowledge hinders effective protection, management, and utilization of these valuable resources. conducting a geospatial analysis of archaeological sites in Ikara LGA is crucial for

several reasons. Among these reasons is Improved site documentation and mapping. Documenting the locations of these sites will be of great importance as it will serve as a method of sites preservation technique and in demonstrating the rich potentials and uniqueness of the area of study in terms of Archaeological sites and culture history. It can also be used to trace the migration patterns of the people who lived in these areas as well determining the connections of the past societies, determining the factors that led to their migrations to the areas and the abandonment.

The research will employ the use of Handheld GPS to collect the coordinates of Archaeological sites in the study area which are going to be presented in Microsoft Excel and saved in CSV format and then imported into the GIS environment for presentation and further analysis.

MATERIALS AND METHODS

Aim and Objectives of The Study

The aim of this study is to carry out the Geospatial

analysis of the Archaeological Sites in Ikara LGA of Kaduna state. This is expected to be achieved through the following designed objectives:

- To locate and map the Archaeological sites in Ikara Local Government area of Kaduna state.
- To determine the pattern of distribution of the Archaeological sites in the area of study
- To examine the finds and features in the sites.

The Study Area

Ikara Local Government area in Kaduna state, Nigeria is located at about 75 kilometres north- east of the city of Zaria (Sowemimo, 2013). It is located between Latitude 11010' 60.00" and 11014'N, Longitude 8012' and 8013'60.00 E and having an elevation of 612m above sea level (Sowemimo, 2013). It shares border with Makarfi in the west, soba and Kubau in the south and Tudun Wada, Kano in the north. Ikara as a district consist of five towns; Ikara, Tudun wada, Nasarawa, Sabon Gari and Hayin Bawa (Sowemimo, 2013) (Fig. 1)

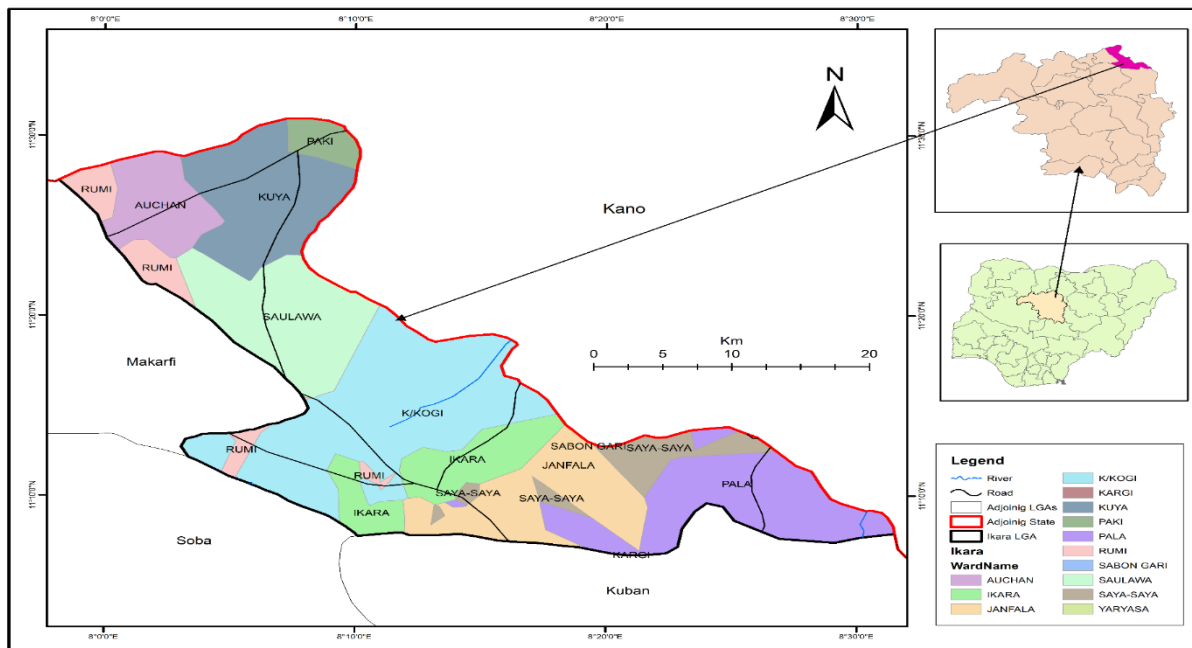


Figure 1: Map of the study Area (Ikara LGA)

Source: Adapted and modified from the

Ikara Local Government area falls within the climatic zone characterized by dry and wet seasons. The dry season stretches between November and April. During this period, the absence of rainfall and the dry atmosphere cause cracks to develop on clay soils (Iloeje, 1981). This period is often characterized by two temperature extremes, by tropical standards (Habu, 2001). The months between November and January of the following year are usually cold and dusty, the dust being as a result of the north-east trade wind from the Sahara. The temperature rises to its peak between February and March after which the south-west trade wind that brings the rainy season will take over. The wet (rainy) season lasts from April to early October;

the rains reach their peak between the months of July, August and September.

Northern Nigeria is underlain by gneisses, migmatites and meta-sediments of Precambrian age (mostly shists, quartzite, and banded iron formations) which have been intruded by a series of granitic rocks of late Precambrian to lower paleozoic age (McCurry, 1979; 1989). The bedrock geology of Ikara Local Government like most parts of north and central Nigeria is predominantly metamorphic rocks of the Nigerian basement complex consisting of biotic gneisses and older granites. The soil is a mixture of soils disintegrated from the local granite, and loess soils brought down by winds from the north

(Iloeje, 1980). Generally, the soils are typical red brown to red yellow tropical ferruginous soils. The soils are rich in brown clay and sand but poor in organic matter. However, soils in the *fadama* (swampy) areas are richer in kaolinitic clay and organic matter, very heavy and poorly drained characteristics vertisols.

Prior to the digging of wells in individual houses and sometimes the drilling of boreholes by government and non-governmental organizations, the major source of water that has sustained Ikara since its earliest occupation is the well *water and stream*. This stream is said to have its source from *Kubau* on the southern part of Ikara

Today, despite the fact that the stream retains water for several months within the year, most people prefer dug wells and drilled boreholes for fear of contacting water borne diseases.

Ikara Local Government Area is within the broadest vegetation zone of Nigeria known as Guinea savanna. Iloeje, (1981) described Guinea savanna “as the broadest vegetation zone in Nigeria, occupying nearly half of its area” (Iloeje, 1980; 1981). The vegetation changes with the seasons. During the wet season, the grasses are usually fresh and green, but in the dry season they wither and die, leaving the whole area bare and hungry, with tall skeletons of charred trees and a ground surface blackened by the ashes of burnt grass (Iloeje, 1980; 1981). Examples of trees found here are the locust beans *Parkia biglobosa*, mango *Mangifera indica*, baobab *Adansonia digitata*, shea butter *Butyrospermum parkii*, neem *Azadirachta indica* etc.

The trees grow in clusters generally not more than six metres high and are interspaced with elephant grass growing to a height of 3 to 3.6 metres.

With over 195, 000 population estimate of 2006 census, there are 10 administrative sub- regions in Ikara which include: Auchan, Ikara, Janfalan, Kurmin Kogi, Kuya, Paki, Pala, Rumi, Saulawa and Saya- Saya (Sowemimo, 2013). Majority of these people are Hausa and Fulani who speak Hausa language and practice mainly Islam and Christianity religion.

There are also other outsiders residing in the area who are often seen as the minorities which include Yoruba and Igbo, who are trading different kinds of goods and services in the area.

METHODOLOGY

Reconnaissance Survey

The Reconnaissance survey of the archaeological sites in the study area was carried out by foot during which fifteen (15) Archaeological sites were discovered, and the sites’ geographic coordinates were taken using handheld Global Positioning Systems.

Data and Sources

Geographic data (Field data) in forms of coordinates was acquired during the reconnaissance survey of the Archaeological sites using the Global Positioning System device. Detailed description of the data types and sources used in this study are presented in Table 1

Table 1: Data Type and Source

Data Type	Sources	Purpose
Geographic Coordinate	Global Positioning Systems (Handheld GPS)	For mapping the location of the archaeological sites in the study area
Oral information	Oral Informants	Serves as a guide for Archaeological site discovery and locating the position of finds and features on the sites as well as their interpretations.
Map	Adapted and modified from the administrative map of Kaduna State	To show the location of the area of study.
Secondary data	Department of Archaeology Library (Published research projects and thesis)	Obtaining more relevant information about the sites in the study area.

Source: Author’s Compilation (2021)

Data Collection Procedure

The coordinates of the positional locations of the archaeological sites in the area of study were collected using the Global Positioning Systems (GPS) receiver. The latitude, longitude and elevation of these sites were recorded to give X, Y and Z coordinates of the sites under study.

Data Processing

The acquired GPS coordinates data are acquired in Degree, minutes and seconds but are converted to Decimal degrees for easy use. The different data processing techniques employed in this research include the following:

Preparation of Data

The data was prepared in Microsoft Excel in which the Latitude and Longitude of the Archaeological sites are recorded, saved in CSV format before being imported into the ArcGIS environment.

Google Imagery Acquisition

The goggle earth imagery of the area was acquired and then georeferenced or was assigned a geographical coordinate so that the GIS mapping software can place the image in its appropriate real-world location to form the boundary of the area of study.

Digitization

The georeferenced goggle earth map was also digitized to get the boundary or extent of the region under study.

Mapping of the Area

After the georeferenced goggle earth imagery of the area has been digitized, it was then imported into the ArcGIS 10.8 software and subsequently, the coordinates of the locations of the archaeological sites stored in excel format was also imported to show the spatial distribution of the sites across the area of study.

Objective 1

To locate and map the Archaeological sites in Ikara Local Government area of Kaduna state was achieved by mapping to show the locations of the Archaeological sites in the study area using the geographic data (latitudes and longitudes) acquired through reconnaissance survey.

Objective 2

To determine the pattern of distribution of the

Archaeological sites in the area of study.

This was achieved by using the sites map to analyze the spatial arrangement of the Archaeological sites in the study area using visual impression.

Objective 3

To examine the finds and features in the sites.

This was achieved by creating a Geodatabase of the various Archaeological sites in the study area which contain the site’s name, ward name, geographic locations and the cultural materials present of the site.

RESULTS AND DISCUSSION

Location and Mapping of Archeological Sites in the Study Area

An archaeological site is a place in which evidence of past activity is preserved, and which has been, or may be, investigated using the discipline of archaeology and represents a part of the archaeological record. The archaeological sites in the study area were identified and presented in Table 2.

Table 2: Location of Archaeological Sites in the Study Area

S/N	Political Ward	Name of Site	Finds	Features
1.	Janfalan	Anguwan Liman	Potsherds	Granary, House Foundation, Mounds
		Malikanchi	Potsherds	Open Grave
2.	Ikara	Gidan Malam	Potsherds	Mounds
		Sabawa	Potsherds, Iron Slags	None
		Unguwan Noma	Stone tools, Potsherds	None
		Anguwan Najide	Potsherds	None
		Anguwan Karofi	Iron Slags, Potsherds	None
3.	Kurmin Kogi	Tsohon Ma	Iron Slags, Potsherds	None
		Danlawal	Iron Slags, Potsherds	None
		Kurmin Kogi	Potsherds, Iron Slags, Grinding Stones	None
4.	Paki	Paki	Iron Slags	House Foundation
5.	Gimba	Gimba	Potsherds	None
6.	Gadas	Gadas	Potsherds	None
7.	Rumi	Shadauro	Potsherds	None
8.	Auchan	Auchan	Potsherds, Stone Tools	None

Source: Field Survey (2022)

It is obvious from Figure 2 below that there are fifteen (15) archaeological sites belonging to different wards in the study area namely: Anguwan Liman, Gidan Malam, Sabawa, Anguwan Noma, Danlawal, Kurmin Kogi, Paki, Gimba, Anguwan Karofi, Tsohon Ma, Gadas, Shadauro, Malikanchi, Anguwan Najide and Auchan.

The result shows that there are six (6) archaeological sites in Ikara ward, two (2) in Kurmin Kogi ward, two (2) in Jamfalan, and two (2) in Auchan ward respectively. This implies that Ikara ward has the highest number of archaeological sites in the study area. This indicates that Ikara ward provides Ikara LGA with the opportunity to

learn about its past cultures and also earn recognition in terms of rich cultural materials through the study of artifacts and other cultural remains on the sites. Studying these artifacts and features will helps to provide the study area with some insight about what life was like for people who left behind no written record.

The finds (movable cultural materials) in the sites are potsherds, stones tools and iron slags while the features include: House foundation, open grave, granary and mounds. The most common finds in the sites are potsherds and iron slags while the most common feature is House foundation, all of which have cultural significances.

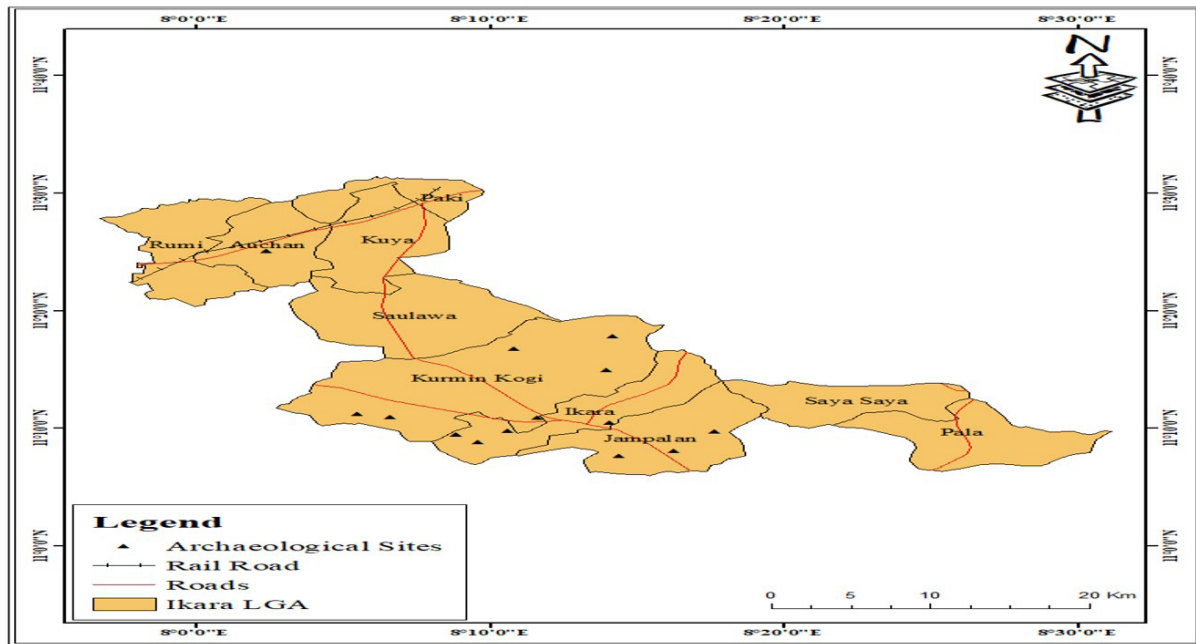


Figure 2: Existing Archaeological Sites in the Study Area
Source: Author's field survey (2022)

Table 3: Political ward with highest number of Archaeological Sites in the Study Area

S/N	Political Ward	Number of Archaeological Sites	Percentage (%)
1.	Janfalan	2	13.3
2.	Ikara	6	40.0
3.	Kurmin Kogi	2	13.3
4.	Paki	1	6.67
5.	Gimba	1	6.67
6.	Gadas	1	6.67
7.	Rumi	1	6.67
8.	Auchan	1	6.67
Total number of Sites		15	100

Source: Field Survey (2022)

The table 3 above show that Ikara ward has the highest number of Archaeological sites with six (6) sites which make up 40% of the total number of sites in the study area and which is followed by Janfalan ward and Kurmin Kogi ward with two sites each of which constitute 13.3% of the total number.

The table 4 above show that the majority of the sites in the study area have finds in forms of Potsherds and Iron slags and grinding stones while 4 (26.6%) have both finds and features while no site with only features was found.

This show that the most common cultural remains on the sites in the study area are finds which form 73.3% of the cultural remains in the sites

Table 4: Different forms of Cultural materials across the Archaeological Sites in the Study Area

S/N	Cultural material	Number of Archaeological Sites	Percentage (%)
1.	Finds only	11	73.3
2.	Features only	0	0.0
3.	Finds and Features	4	26.67
Total number of Sites		15	100

Source: Field Survey (2022)

Table 5: Different types of finds across the Archaeological Sites at the Study Area

S/N	Finds	Number of sites with the finds	Percentage (%)
1.	Potsherds	14	93.3
2.	Iron slags	6	40.0
3.	Stone tools	3	20
Total number of Sites with finds		15	100

Source: Field Survey (2022)

Table 5 above show that potsherds are the dominant cultural remains on the sites in the study area with 93.3% of the total finds as it was found in all the sites, iron slags seconded with 40% and it was found at six (6) sites which form 40% of the total number of sites with finds.

Table 6: Different types of features across the Archaeological Sites at the Study Area

S/N	Finds	Number of sites with the feature	Percentage (%)
1.	House Foundation	2	50
2.	Mound	1	25
3.	Open grave	1	25
Total number of Sites with features		15	100

Source: Field Survey (2022)

The analysis of Archaeological sites with features show that house foundation is the dominant feature across all the sites in the study area with 50%, followed by mounds and open graves in equal proportion of 25% each

Spatial Pattern of Distribution of Archaeological Sites in the Study Area

The spatial pattern of a distribution is defined by the arrangement of individual entities in space and the geographic relationships among them. The capability of evaluating spatial patterns is a prerequisite to understanding the complicated spatial processes underlying the distribution of a phenomenon. The Average Nearest Neighbor tool measures the distance between each feature centroid and its nearest neighbor's centroid location. It then averages all these nearest neighbor distances. If the average distance is less than the average for a hypothetical random distribution, the distribution of the features being analyzed is considered clustered. If the average distance is greater than a hypothetical random distribution, the features are considered dispersed. The pattern of distribution of archaeological sites is presented in Figure 3.

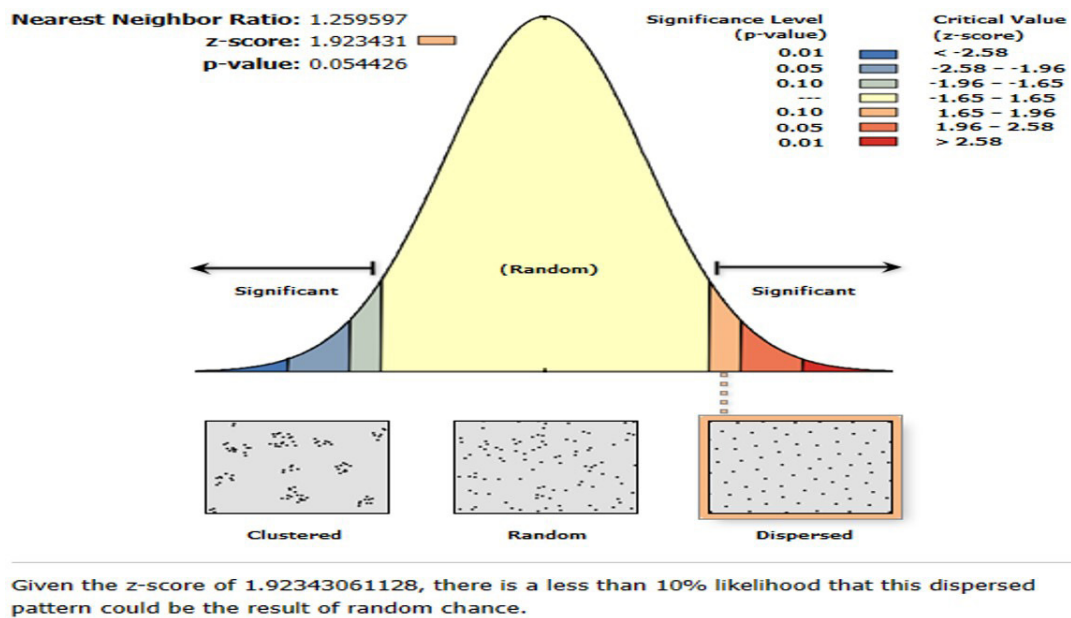


Figure 3: Pattern of Distribution of Archaeological Sites in the Study Area

Source: Author's field survey (2022)

Figure 3 shows random points at 0.01% significance level with the Nearest Neighbour Ratio (NNR) of 1.259597. Given the z-score of -1.92343061128 is very far from 1 and did not falls within the range of -1.65 to 1.65 which makes it dispersed distribution which implies that the archaeological sites are isolated in the study area. Spatial distribution of archaeological sites in the study area is dispersed, the isolated spatial pattern of archaeological sites in the study represents a huge opportunity to increase efforts to protect and promote archaeological tourism. The result corroborates the findings of Obong, Ajake, Aniah, Ukam, Uttah and Obong, (2015) who utilized Nearest Neighbour analysis to examine the spatial pattern of archaeological tourism sites and reported that they are dispersed. Even with the dispersed distribution of archaeological sites, some wards like Kurmin Kogi and

Ikara still have high concentration of sites. This could be because they are the commercial and traditional center of the study area.

Examine the Finds and Features in the Sites

A Geo-Spatial database of all the find and features in the archaeological sites was created for relevant Query Statements and subsequent analysis. Thus, coordinates of various points of interest (Archaeological sites) are obtain using GPS and all the necessary information for each point was entered into its layer's attribute table and stored.

This was achieved by adding required number of fields (columns) to the table and inputting the data for all the Archaeological and tourism sites features in their corresponding records (rows) in Microsoft Excel and

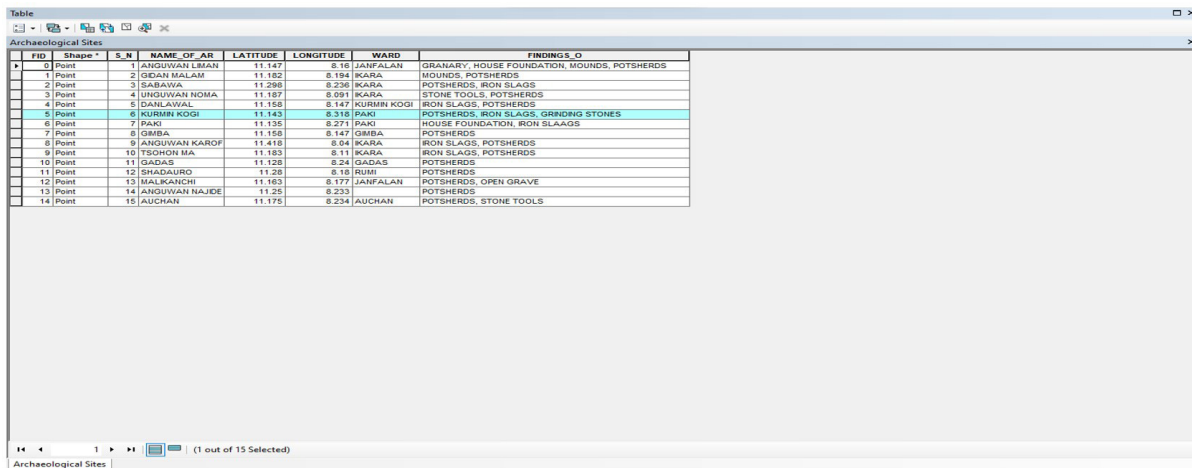
imported into ArcGIS 10.8 software environment using Arc catalog to enable Archaeologist and Tourist to identify which artefact or features are found in a particular Archaeological site.

Furthermore, Geodatabase plays an important role in GIS analysis. It offers opportunity for information on find or features to be stored, manipulated, retrieved and updated with time. It is the process whereby real-world entities and their interrelationships are analyzed and modeled in such a way that maximum benefits are derived while utilizing minimum amount of data (Damilola, 2015).

A geodatabase was created not just to help in satisfying the third objectives of this work, but also for future purposes since data in a database can be updated with time. The geodatabase contains both spatial and attribute

data of the cultural remains in the sites. These cultural remains are finds or artefacts like potsherds, iron slags and stone tools while the features are house foundation, mounds and granary.

The research findings presented in the table show that, out of the fifteen Archaeological sites, all the fifteen (15) of them contain 'finds' majority of which are potsherds, iron slags and relatively few have grinding stones and stone tools. The dominant features in the sites are house foundations, mounds and one granary and an open grave. An inventory of the Geodatabase is presented in Figure 4. From the query of Figure 4, it can be seen that there are fifteen (15) archaeological sites in the study area. It also shows the numerous finds and features found at the various archaeological sites.



ID	Shape	S.N	NAME_OF_AR	LATITUDE	LONGITUDE	WARD	FINDINGS_O
0	Point	1	ANGUWAN LIMAN	11.147	8.16	JANFALAN	GRANARY, HOUSE FOUNDATION, MOUNDS, POTSHERDS
1	Point	2	GIDAN MALAM	11.182	8.194	IKARA	MOUNDS, POTSHERDS
2	Point	3	SABA'AWA	11.298	8.236	IKARA	POTSHERDS, IRON SLAGS
3	Point	4	UNGUWAN NOMA	11.187	8.091	IKARA	STONE TOOLS, POTSHERDS
4	Point	5	DANLAWAL	11.158	8.147	KURMIN KOGI	IRON SLAGS, POTSHERDS
5	Point	6	KURMIN KOGI	11.143	8.318	PAKI	POTSHERDS, IRON SLAGS, GRINDING STONES
6	Point	7	PAKI	11.135	8.271	PAKI	HOUSE FOUNDATION, IRON SLAAGS
7	Point	8	GIMBA	11.158	8.147	GIMBA	POTSHERDS
8	Point	9	ANGUWAN KAROF	11.418	8.04	IKARA	IRON SLAGS, POTSHERDS
9	Point	10	TSOHON MIA	11.183	8.11	IKARA	IRON SLAGS, POTSHERDS
10	Point	11	GADAS	11.128	8.24	GADAS	POTSHERDS
11	Point	12	SHADAURO	11.28	8.18	RUMI	POTSHERDS
12	Point	13	MALKANCHI	11.163	8.177	JANFALAN	POTSHERDS, OPEN GRAVE
13	Point	14	ANGUWAN NAJIDE	11.25	8.233		POTSHERDS
14	Point	15	AUCHAN	11.175	8.234	AUCHAN	POTSHERDS, STONE TOOLS

Figure 4: Inventory of Features of Archaeological Sites

Source: Author's field survey (2022)

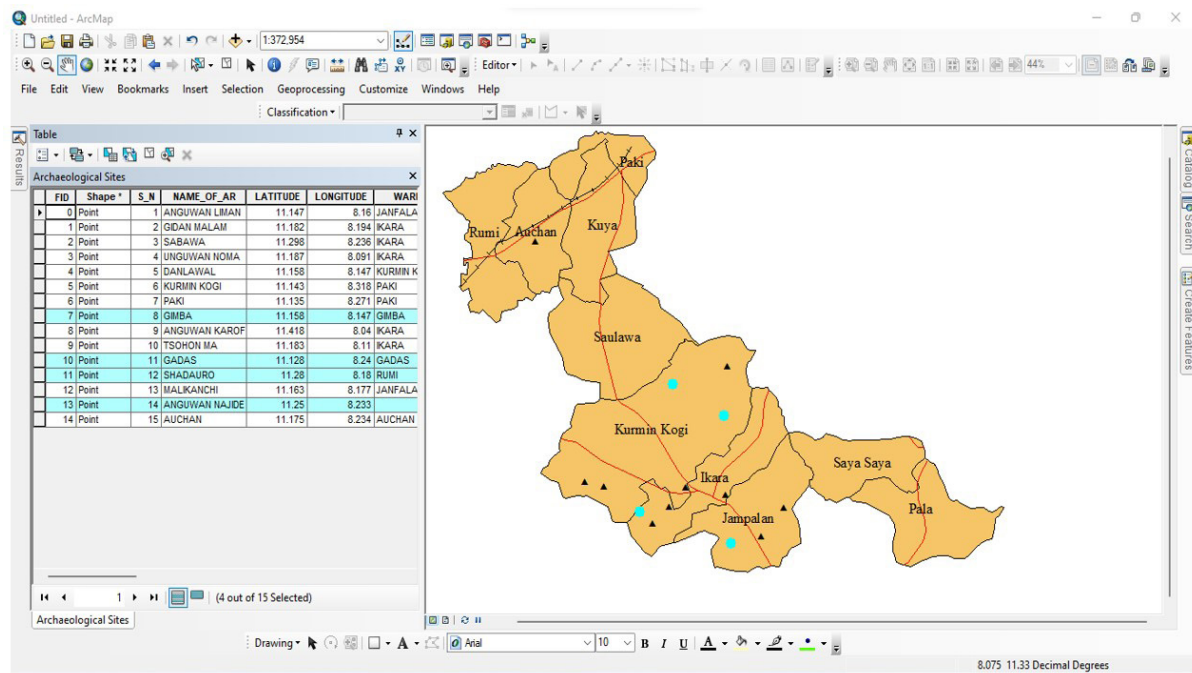


Figure 5: Archaeological Sites with Only Potsherds in the Study Area

Source: Author's field survey (2022)

A query in to the database as seen in Figure 5 reveal that only four (4) site have only potsherd in the study area, hence no feature was found in the sites. Mainly these sites are located in Kurmin Kogi, Ikara and Jamfalan wards in the study area.

CONCLUSION

The study analyzed the spatial distribution of Archaeological sites in Ikara Local Government Area of Kaduna State Nigeria. GIS and quantitative techniques were adopted to locate and map Archaeological sites, examine the pattern of distribution of archaeological sites and create a geodatabase for Archaeological sites to examine the finds and features across the sites in the study area.

The study shows Eight (8) wards with fifteen (15) Archaeological sites in the study area. The sites are namely: Anguwan Liman, Gidan Malam, Sabawa, Unguwan Noma, Danlawal, Kurmin Kogi, Paki, Gimba, Anguwan Karofi, Tsohon Ma, Gadas, Shadauro, Malikanchi, Anguwan Najide and Auchan.

The result shows that there are six (6) archaeological sites in Ikara ward, (2) in Kurmin Kogi ward, two (2) in Jamfalan, and one (1) in Auchan ward respectively with Ikara ward having the highest number of Archaeological sites in the study area.

The study also reveals that the dominant cultural materials across the sites in the study area are found in the form of potsherds and features in the form of the House foundations.

Furthermore, the study also shows random points at 0.01% significance level with the Nearest Neighbour Ratio (NNR) of 1.259597. Given the z-score of -1.92343061128 is very far from 1 and did not fall within the range of -1.65 to 1.65, which makes it a dispersed distribution, which implies that the archaeological sites are isolated in the study area.

In conclusion the study identified fifteen (15) Archaeological sites within the study area and further analyzed their distributions and patterns. The cultural remains on these Archaeological sites are House foundations, mounds, granary, potsherds, iron slag, open grave, stone tools and grinding stones.

Based on the findings of this research, the dispersed pattern of the Archaeological sites in the study area was deduced from the data collected, especially in the southern part of the area of study, where these sites are found to be most concentrated.

REFERENCES

Allen, S., Green, E. and Zubrow E. (1990). *Interpreting Space: GIS and Archaeology*. Taylor and Francis, London

Anderson, K. L., & Burke, A. (2008). Refining the definition of cultural levels at Karabi Tamchin: a quantitative approach to vertical intra-site spatial analysis. *Journal of Archaeological Science*, 35(8), 2274-2285.

Armstrong, D. & Mark W. (2004). An East Indian Laborers' Household in Nineteenth-Century Jamaica: A Case for Understanding Cultural Diversity through Space, Chronology, and Material Analysis. *Historical Archaeology* 38(2), 9-21.

Ashurst, J. & Shalom, A. (2012). The Demise, Discovery, Destruction and Salvation of a Ruin (2007) in "Archaeological Sites: Conservation and Management". Los Angeles: The Getty Conservation Institute. pp. 353-364.

Bate, L., Emma K. (2011). *Ceramic Technology and Spanish Contact: Analysis of Artifacts from the Long Bay Site, San Salvador Island, The Bahamas*. Ph.D. Dissertation, Department of Anthropology, Indiana University, Bloomington.

Belmonte, J., Esteban, C., Cuesta, L., Gonzalez, J. (1999). Pre-Islamic burial monuments in Northern and Saharan Morocco. *Archaeo- astronomy* 1999, 30, 21.

Benjamin W. K & Christopher R. D. (2004). Ghana's Vanishing Past: Development, Antiquities, and the Destruction of the Archaeological Record. *African Archaeological Review* v. 21, #2, pp. 89- 128

Bewley, R., Donoghue, D., Gaffney, V., Van Leusen, M., Wise, A (1999). *Archiving Aerial Photography and Remote Sensing Data: A Guide to Good Practice*; Archaeology Data Service; Oxbow Books: Oxford, UK.

Burrough, P. (1994). *Principles of Geographical Information Systems for land resources Assessment*. Oxford Science

Constantinidis, D. (2009). GIS for managing the analysis and protection of archaeological remains in the Willandra Lakes World Heritage Area. *Archaeology in Oceania*, 44(2), 112-118.

Cunliffe, E. (2014). Archaeological Site Damage in the Cycle of War and Peace:: A Syrian Case Study. *Journal of Eastern Mediterranean Archaeology & Heritage Studies*, 2(3), 229-247.

Curet, L. A. (1992). House structure and cultural change in the Caribbean: Three case studies from Puerto Rico. *Latin American Antiquity*, 3(2), 160-174.

Fagan, M. B (2000). *Ancient Lives*. New York: Preston hall Publishers

Faleye, O. A. (2016). Toward a Historical Archaeology of West African Borderlands. *International Journal of Modern Anthropology*, 1(9), 77-89.

Fitz, P. and Scott, M. (2006). A Critical Approach to 14C Dating in the Caribbean: Using Chronometric Hygiene to Evaluate Chronological Control and Prehistoric Settlement. *Latin American Antiquity* 17, 389-418.

Fitzpatrick, S. M., Kappers, M., & Kaye, Q. (2006). Coastal erosion and site destruction on Carriacou, West Indies. *Journal of Field Archaeology*, 31(3), 251-262.

Fitzpatrick, S. M., Kaye, Q., Kappers, M., Technics, I. T. S., & Majofskistraat, T. (2004). A radiocarbon sequence for the Sabazan site, Carriacou, West Indies. *Journal of*

- Caribbean Archaeology*, 5(1), 1-11.
- Gaydarska, B. (2014). Spatial analysis in field Archaeology. In Smith C (eds). *Encyclopedia of Global Archaeology*. Springer, New York, NY
- Grant, J., Gorin, S. and Fleming, N. (2008). *The Archaeology Course Book; An Introduction to Themes, Method and Skills* (3rd ed.). Routledge Taylor and Francis Group, London.
- Greene, K., (1991). *Archaeology; An Introduction (Revised Edition)*. London, Batsford Ltd.
- Jones, R. E. Sarris, A. J (2000). Geophysical and related techniques applied to Archaeological survey in the Mediterranean: A review. *J. Mediterr. Archaeol.* 2000, 13, 3–75.
- Kappers, M., Scott M. Fitz P., and Quetta, K. (2007). Automated Data Collection and 3D Modelling of Archaeological Sites: Examining the Prehistory and Destruction of Grand Bay in Carriacou. Edited by Basil A. Reid, pp. 81-90
- Kaye, Q. (2003). A field survey of the island of Carriacou, West Indies, March 2003. *Papers from the Institute of Archaeology*, 14, 129-135.
- Kappers, M. (2007). Ongoing Archaeological Investigations on Carriacou, West Indies: 2nd July to 3rd August, 2007. *Papers from the Institute of Archaeology*, 18, 167-176.
- Kottak P. C (2000). *Anthropology, The exploration of Human diversity (9th edition)* University of Michigan.
- Kvamme, K. L. (2003). Geophysical surveys as landscape archaeology. *Am. Antiq.*
- Lasaponara, R., Masini, N. (2012). *Satellite Remote Sensing: A New Tool for Archaeology*; Springer Science & Business Media: Cham, The Netherlands
- López, C., & Bernabé, M. (2012). *Fundamentos de las Infraestructuras de Datos Espaciales*. Madrid, España.
- Montufo, A. M (1997). The use of satellite imagery and digital image processing in landscape archaeology: A case study from the island of Mallorca, Spain.
- Neubauer, W. (2001). Images of the invisible- prospection methods for the documentation of threatened archaeological sites. *Naturwissenschaften* 2001, 88, 13–24.
- Renfrew, C & Bahn, P. (2008). *Archaeology: Theories, Methods and Practice*. (5th Edition). London, Thames and Hudson Ltd.
- Scianna, A., & Villa, B. (2011). *GIS Applications in Archaeology*. Italian National Research Council, Italy.
- Sutton, M. O. (2006). *Archaeology; The Science of Human past*. Pearson Educational Inc, USA. www.en-ng.topographic-map.com/maps/ghvl/Ikara/ retrieved on 4th February, 2020 (01:33pm)
- Theocaris, P. S., Liritzis, I., Lagios, E., & Sampson, A. (1996). Geophysical prospection, archaeological excavation, and dating in two Hellenic pyramids. *Surveys in Geophysics*, 17, 593-618.
- UNESCO (2018). List of Endangered sites. www.africanworldheritagesites.com Retrieved on 14th June, 2021 (01:33pm)
- Wynn, J. (1990). Applications of High-resolution Geophysical methods to Archaeology. In *Archaeological Geology of North America Centennial Special Volume*; Lasca, N.P., Donahue, J., Eds.; Geological Society of America: Boulder, CO, USA, 1990; pp. 603- 617.