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Using geoinformatics to reduce cultural extinction, language and cultural identity crises, disappearing cultural landscapes and cultural heritage loss among the Igbos of Southeast, Nigeria

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ABSTRACT

The rapid erosion of indigenous cultures, declining language use, and the disappearance of cultural landscapes threaten the long-term sustainability of Igbo cultural heritage in Southeast Nigeria. This study evaluated the potential of geoinformatics to support the preservation of cultural identity, endangered heritage resources, and indigenous languages. A descriptive survey combined with geoinformatics-based spatial analysis was conducted using data from 150 respondents drawn from local communities, cultural organizations, and academic institutions. Data were collected through structured questionnaires, interviews, field observations, GPS-based mapping, and geospatial datasets, and were analyzed using descriptive statistics and thematic analysis. The findings identified westernization and globalization (88.0%), declining youth interest in cultural practices (85.3%), and reduced indigenous language use (83.3%) as the principal drivers of cultural extinction. Respondents identified sacred forests and groves (84.0%) and traditional homestead compounds (83.3%) as the most endangered cultural landscapes. Cultural identity crises were strongly associated with preference for Western lifestyles (mean = 3.32) and the gradual disappearance of indigenous religious beliefs (mean = 3.31). Geoinformatics was widely recognized for mapping cultural heritage sites (88.0%), creating spatial databases (84.0%), monitoring landscape changes through remote sensing (86.0%), and digitally documenting indigenous language resources (87.3%). Furthermore, respondents strongly supported the creation of digital archives for languages, artifacts, and traditions (93.3%) and increased government investment in geoinformatics infrastructure (90.7%) as key conservation strategies. The study concludes that integrating geoinformatics into cultural heritage management provides an effective, evidence-based approach for safeguarding endangered cultural landscapes, preserving indigenous languages, and strengthening Igbo cultural identity for future generations.

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INTRODUCTION

The accelerating pace of globalization, urbanization, modernization, and technological change has had a profound impact on indigenous cultures worldwide. In numerous developing nations, including Nigeria, these dynamics have played a key role in the gradual decline of native languages, cultural identities, traditional values, and the physical environments tied to heritage.

Among the Igbo communities of Southeast Nigeria, signs of cultural erosion are becoming more evident—seen in the shrinking use of the Igbo language, the loss of sacred spaces, the disappearance of traditional buildings, and the weakening intergenerational transfer of cultural knowledge (Nwaka, 2020). Factors such as the growing preference for foreign languages, rural-to-urban migration, shifts in religious practices, and evolving socio-economic conditions have deepened the challenges to cultural identity within these communities.

Cultural heritage reflects the shared history, memory, and identity of a people. It encompasses both tangible elements—such as shrines, monuments, sacred forests, ancestral homes, artifacts, and culturally significant landscapes—and intangible aspects like language, oral histories, music, festivals, and traditional knowledge systems (UNESCO, 2019; UNESCO, 2013; UNESCO, 2011).

For the Igbo, this heritage is vital for maintaining social unity, collective identity, and indigenous wisdom. Yet, many of these cultural assets in Southeast Nigeria are vanishing due to environmental damage, insufficient documentation, shifting land uses, insecurity, and the absence of robust preservation frameworks (Okpoko and Ezech, 2018; Eze, 2016; Njoku, 2013).

Geoinformatics has emerged as a valuable tool in the effort to manage and protect cultural heritage. This field combines technologies such as Geographic Information Systems (GIS), Remote Sensing, GPS, digital cartography, spatial databases, and other

geospatial methods to collect, analyze, store, and visualize geographic data (Longley *et al.*, 2015; Goodchild, 2007).

These tools can be used to locate, map, monitor, and record endangered cultural sites, including traditional settlements, sacred groves, historical landmarks, and patterns of language use. By leveraging geospatial technology, researchers and decision-makers can build digital records and spatial inventories that help prevent the irreversible loss of cultural resources.

In Southeast Nigeria, geoinformatics holds strong potential for supporting the preservation of Igbo cultural identity. It enables the digital documentation of heritage sites, the mapping of at-risk communities, and the tracking of changes affecting cultural landscapes. GIS-based cultural mapping can reveal regions where the Igbo language is fading, while remote sensing can detect environmental and land-use shifts endangering sacred sites and traditional villages (Akinyemi, 2021). Moreover, geoinformatics offers a pathway to combine traditional knowledge with modern technological approaches for more sustainable management of cultural assets.

These technologies also enhance public awareness and education by enabling interactive digital maps, virtual heritage platforms, and online databases accessible to scholars, students, and policy planners. Such tools can support initiatives in language revitalization, cultural tourism, and heritage conservation among the Igbo. As a result, integrating geoinformatics into cultural preservation strategies offers a practical means of addressing cultural extinction, language loss, identity challenges, and the degradation of cultural landscapes in the region.

The Igbo people of southeast, Nigeria: A brief summary

The Igbo are one of Nigeria's three major ethnic groups and are primarily located in the southeastern part of the country. Their traditional homeland includes five main states—Abia, Anambra, Ebonyi, Enugu, and Imo—though sizable Igbo communities also live in areas of

Delta and Rivers States, as well as in urban centers throughout Nigeria and abroad. Known for their vibrant cultural traditions, strong emphasis on education, community-driven development, and a deeply rooted entrepreneurial mindset, the Igbo have long maintained a distinct social identity (Afigbo, 1981). While their culture has adapted over time, it continues to reflect enduring values that shape Igbo life. Historical records and archaeological findings point to sophisticated societies in the region centuries ago, including the Kingdom of Nri, which arose around the 9th century and served as a key spiritual and cultural hub in Igboland (Isichei, 1976). In contrast to many centralized African polities, traditional Igbo society was largely decentralized, with self-governing communities relying on inclusive decision-making. Leadership roles were shared among elders, titleholders, age-grade associations, and village councils, fostering accountability and unity within communities (Afigbo, 1981).

The Igbo language, part of the Benue-Congo subgroup within the Niger-Congo family, is a central element of ethnic identity. Despite regional dialectal variations, the development of Standard Igbo has supported communication and educational advancement (Ugwuoke, 2019).

Language plays a crucial role in sustaining cultural knowledge, oral history, proverbs, folktales, and traditional wisdom, all of which are passed down through generations via storytelling, music, and ceremonial practices. Religion has also been foundational in shaping Igbo worldviews. Prior to colonial contact, spiritual life revolved around the worship of Chukwu, the supreme deity, alongside reverence for ancestors and various nature-linked deities (Basden, 1966). The spread of Christianity during British rule brought major shifts in religious and social structures. Today, most Igbo identify as Christian, yet traditional beliefs still inform many cultural expressions and perspectives (Korieh, 2010).

Economically, the Igbo are widely recognized for their involvement in trade and enterprise.

Traditionally, agriculture formed the backbone of their economy, with yam, cassava, cocoyam, and oil palm as staple crops. The yam holds particular cultural significance and is honored annually during the New Yam Festival, a celebration symbolizing harvest, thanksgiving, and communal solidarity (Isichei, 1976). In modern times, Igbo businesspeople have built enterprises across multiple sectors, contributing meaningfully to Nigeria's economic growth. Their adaptability and initiative have enabled migration and success in various global settings, while many maintain close connections to their roots. Colonial rule introduced new systems of governance, education, and commerce that reshaped existing institutions. After Nigeria gained independence in 1960, rising political tensions led to the Nigerian Civil War (1967–1970), when the southeast sought to establish the Republic of Biafra. The conflict caused widespread suffering, loss of life, displacement, and economic decline for the Igbo people (Achebe, 2012).

Yet, their resilience during the recovery period became a defining aspect of their collective experience.

Today, the Igbo remain influential in Nigeria's political, economic, and cultural spheres. Their contributions to education, literature, science, business, and public service continue to support national progress. Even amid the pressures of globalization, modernization, and shifting social dynamics, they have sustained core elements of their heritage through festivals, language initiatives, traditional leadership, and civic organizations. A deeper understanding of Igbo history, culture, and socio-economic impact is vital to recognizing Nigeria's ethnic diversity and the role indigenous groups play in shaping the nation (Falola and Heaton, 2008). The Igbo people of Southeast Nigeria are confronting growing threats to their cultural survival, including the erosion of language, the loss of cultural landscapes, and the disappearance of heritage, driven by modernization, global influences, urban sprawl, migration, religious transformation, and environmental decline. Traditional practices, sacred

forests, ancestral compounds, festivals, and oral traditions are slowly fading, while younger generations increasingly embrace external languages and lifestyles, often at the cost of indigenous values. This shift has led to a crisis in cultural identity and disrupted the continuity of Igbo heritage.

Despite the critical role cultural heritage plays in sustaining communal identity and historical awareness, there remains a lack of systematic documentation and spatial mapping of cultural resources across the region. Many heritage sites remain unrecorded, unprotected, and at risk of destruction from infrastructure projects, deforestation, soil erosion, and neglect. Current preservation efforts are frequently hindered by limited use of technology, incomplete spatial data, and the absence of comprehensive cultural inventories. Although geoinformatics tools like GIS, GPS, and Remote Sensing have demonstrated success in cultural conservation globally, their application in safeguarding Igbo heritage remains underdeveloped. There is therefore a pressing need to explore how these technologies can be effectively employed to combat cultural extinction, address language and identity challenges, and protect disappearing cultural landscapes and heritage assets among the Igbo communities of Southeast Nigeria. The main objective of this study is to examine the role of geoinformatics in reducing cultural extinction, language and cultural identity crises, disappearing cultural landscapes, and cultural heritage loss among the Igbos of Southeast Nigeria. The specific objectives are to: a). examine the major causes of cultural extinction and heritage loss among the Igbos of Southeast Nigeria; b). identify endangered cultural landscapes and heritage resources in Southeast Nigeria; c). assess the influence of geoinformatics technologies in documenting and preserving Igbo cultural heritage; d). examine the role of GIS and remote sensing in monitoring disappearing cultural landscapes; e). investigate how geoinformatics can support indigenous language preservation and cultural identity promotion among the Igbos; f). suggest geospatial and technological strategies for

improving cultural heritage conservation and management in Southeast Nigeria. This research holds significance as it supports the preservation and long-term sustainability of Igbo cultural heritage, native language, and cultural identity. Its outcomes will offer practical insights for government bodies, cultural institutions, scholars, urban planners, and policy makers engaged in safeguarding heritage and managing cultural resources. Additionally, the study highlights how geoinformatics tools can effectively document and protect vulnerable cultural landscapes and heritage assets. Through digital cultural mapping and spatial recording methods, it aims to minimize the threat of irreversible cultural loss. The work also advances academic understanding in geoinformatics, cultural studies, heritage management, and environmental planning.

MATERIALS AND METHODS

The research took place in Southeast Nigeria, the historical homeland of the Igbo ethnic group. This area encompasses five states: Abia, Anambra, Ebonyi, Enugu, and Imo. It was chosen for its representation of the cultural, linguistic, and historical core of the Igbo people, where a wealth of cultural heritage sites, traditional institutions, and indigenous knowledge have thrived. However, the region has faced challenges due to rapid urbanization, increasing population, infrastructural development, and environmental degradation, leading to the gradual erosion of cultural landscapes and a decline in the use of indigenous languages (Nwaka, 2020). The study analyzed both rural and urban communities to understand the differences in cultural preservation and loss.

Rural areas were included for their retention of traditional practices and landscapes, while urban settings were examined for their susceptibility to modernization and cultural assimilation. A descriptive survey research design, paired with geoinformatics-based spatial analysis techniques, was utilized. This approach was deemed suitable as it allowed for the collection of both quantitative and qualitative data regarding cultural extinction, language decline, and the loss of cultural heritage, all while incorporating spatial

mapping to investigate the physical cultural landscapes. Additionally, a mixed-methods approach was adopted, integrating field-based geospatial data collection with social survey techniques to create a comprehensive understanding of cultural shifts among the Igbo community in Southeast Nigeria. The geoinformatics aspect involved employing Geographic Information Systems (GIS), Global Positioning Systems (GPS), and Remote Sensing methods to identify, map, and analyze cultural heritage sites and landscapes that had suffered degradation or loss. The research also analyzed satellite imagery and spatial datasets to observe land-use changes impacting cultural landscapes, such as sacred forests, traditional compounds, shrines, and historical monuments. This methodology corresponds with the work of Longley *et al.* (2015), who highlighted the effectiveness of GIS-based spatial analysis in observing changes in environmental and cultural contexts over time. The study also embraced participatory mapping methods, allowing community members to share their indigenous knowledge about cultural landmarks, historical sites, and areas of linguistic significance. This inclusive strategy integrated local insights into geospatial data, enhancing both the accuracy and cultural pertinence of the results. Data for this investigation were gathered from a mix of primary and secondary sources. Primary data collection involved structured questionnaires, key informant interviews, focus group discussions, field observations, and the acquisition of geospatial data. The structured questionnaires targeted various respondents, including traditional leaders, cultural guardians, community elders, youths, local leaders, and academics. These questionnaires aimed to collect information regarding perceptions of cultural extinction, language decline, and the influence of geoinformatics on cultural preservation. A total of 150 questionnaires were distributed across selected communities in five states in Southeast Nigeria, utilizing a stratified sampling approach to ensure diversity. Key informant interviews were conducted with experts in geoinformatics, cultural heritage management, linguistics, and anthropology. These discussions yielded rich qualitative insights into the

use of GIS and remote sensing for cultural documentation and preservation. Additionally, focus group discussions were held in chosen communities to gather collective views on issues related to cultural identity and vanishing cultural landscapes. Through field observations, cultural heritage sites such as sacred groves, shrines, ancient trees, traditional markets, and historical buildings were physically identified, verified, and documented. GPS devices were employed during these observations to accurately record the locations of cultural sites, which were subsequently imported into GIS software for spatial analysis. Satellite imagery and remotely sensed data were collected to evaluate changes in land use and land cover over time. This data helped identify regions where cultural landscapes were supplanted by urban development, agricultural growth, or environmental deterioration. As noted by Akinyemi (2021), remote sensing offers reliable temporal data crucial for tracking changes in environmental and cultural landscapes. Complementary secondary data were sourced from textbooks, academic journals, government publications, UNESCO cultural heritage documents, archival records, and previous research studies. These sources furnished essential background information and aided in the interpretation of primary findings (UNESCO, 2019). The gathered data were analyzed employing both quantitative and qualitative analytical methods. Quantitative data collected through questionnaires were examined using descriptive statistics, including frequency distribution tables, percentages, and average scores. These statistical methods helped to condense the opinions of respondents regarding issues like cultural extinction, the decline of languages, and the role of geoinformatics in preserving heritage. On the other hand, qualitative data gathered from interviews and focus group discussions were scrutinized using thematic content analysis.

This process involved pinpointing common themes, such as the loss of cultural identity, language endangerment, the impact of modernization, and strategies for geospatial preservation.

RESULTS AND DISCUSSION

Major causes of cultural extinction and heritage loss among the Igbos of southeast Nigeria

Table 1 outlines the primary factors contributing to cultural erosion and heritage loss among the Igbo people of Southeast Nigeria, based on responses from 150 participants. Westernization and globalization emerged as leading causes, cited by 132 respondents (88.0%), reflecting how exposure to foreign cultures, values, and ways of life has led many to move away from traditional Igbo customs and beliefs (Nwaka, 2020; UNESCO, 2019). A lack of engagement from younger generations was also highlighted, with 128 respondents (85.3%) identifying it as a key issue. This points to reduced participation by youth in cultural festivals, traditional institutions, and indigenous practices, raising concerns about the long-term survival of Igbo cultural identity. Language decline was reported by 125 respondents (83.3%), indicating that the growing preference for English and other non-native languages among young people is accelerating the erosion of local dialects and traditional forms of communication (Ugwuoke, 2019; UNESCO, 2011). Religious shifts were noted by 121 respondents (80.7%), with the spread of Christianity and Western religious norms seen as undermining indigenous belief systems, sacred rituals, and traditional spiritual practices. Urban development and infrastructure projects were mentioned by 118 respondents (78.7%), suggesting that expanding cities, road construction, and modernization efforts have damaged or destroyed culturally significant sites such as sacred groves and ancestral compounds. The migration of youth to urban areas was identified by 114 respondents (76.0%), indicating that rural-urban movement has disrupted the transfer of cultural knowledge, values, and traditions between generations.

Insufficient government support for cultural preservation was acknowledged by 111 respondents (74.0%), pointing to weak policies, limited funding, and a lack of institutional frameworks dedicated to safeguarding cultural heritage in the region. Poor

documentation of cultural assets was reported by 109 respondents (72.7%), revealing that many oral histories, festivals, traditions, and historical locations remain unrecorded or undigitized, increasing their vulnerability to irreversible loss. Environmental damage, including deforestation and land-use changes, was linked to the degradation of sacred sites by 103 respondents (68.7%), showing how ecological changes are erasing culturally important landscapes. Lastly, the influence of modern technology and social media was recognized by 97 respondents (64.7%), suggesting that digital platforms and global media content are reshaping cultural preferences and drawing attention away from traditional Igbo values. In sum, the results indicate that cultural extinction among the Igbo is primarily driven by globalization, declining language use, youth disengagement, religious change, and urban development. These findings agree with previous studies reporting that rapid modernization and globalization are major contributors to indigenous cultural erosion in Africa (Eze, 2016; Nwaka, 2020).

Table 2 outlined respondents' perceptions regarding Igbo cultural landscapes considered at risk of disappearing. Because participants could select multiple options, the total number of responses exceeded the 150 individuals surveyed. Sacred forests and groves were seen as the most threatened, with 126 respondents (84.0%) identifying them as endangered. This finding is consistent with UNESCO (2019) and Okpoko and Ezech (2018), who emphasized that sacred natural site, are among the most vulnerable forms of cultural heritage because of urban expansion and environmental degradation. This points to significant pressure from urban development, deforestation, agricultural expansion, and modernization, all of which have undermined the protection of these ecologically and spiritually significant areas traditionally maintained through indigenous customs. Traditional homesteads and mud-built structures followed closely, cited by 125 respondents (83.3%). The decline of these architectural forms reflects a shift toward contemporary housing designs and Western influences, gradually replacing building methods that once

embodied Igbo cultural values and community-based living. Ancestral shrines and ritual sites were marked as endangered by 121 respondents (80.7%), highlighting the impact of Christianity's spread, evolving religious beliefs, and diminishing engagement

with indigenous spiritual practices, all contributing to the erosion of traditional sacred spaces. Traditional village squares (Ama/Otobo), essential for gatherings, dispute resolution, and cultural events, were identified as at risk by 118 respondents (78.7%).

Table 1. Major causes of cultural extinction and heritage loss among the Igbos of southeast Nigeria

Sl Causes of cultural extinction and heritage loss	Frequency	Percentage
1 Westernization and globalization	132	88.0
2 Decline in indigenous language usage	125	83.3
3 Urbanization and infrastructural development	118	78.7
4 Migration of youths to urban centers	114	76.0
5 Poor documentation of cultural heritage	109	72.7
6 Religious influence and abandonment of traditional beliefs	121	80.7
7 Destruction of sacred forests and cultural landscapes	103	68.7
8 Lack of government support for cultural preservation	111	74.0
9 Modern technology and social media influence	97	64.7
10 Declining interest among younger generations	128	85.3
Cultural landscapes at risk of extinction among the Igbos of Southeast Nigeria		

Table 2. Cultural landscapes at risk of extinction among the Igbos of southeast Nigeria

Sl Cultural landscapes at risk of extinction	Frequency	Percentage
1 Sacred forests and groves	126	84.0
2 Traditional village squares (Ama/Otobo)	118	78.7
3 Ancestral shrines and ritual sites	121	80.7
4 Traditional market landscapes	109	72.7
5 Historic community meeting grounds	102	68.0
6 Ancient footpaths and trade routes	97	64.7
7 Traditional farming terraces and farmlands	110	73.3
8 Sacred rivers and streams	114	76.0
9 Masquerade performance arenas	106	70.7
10 Traditional burial grounds and ancestral cemeteries	111	74.0
11 Heritage sites of traditional rulers' palaces	104	69.3
12 Indigenous craft and blacksmithing locations	99	66.0
13 Traditional festivals' cultural spaces	113	75.3
14 Ancient community boundary landmarks	92	61.3
15 Traditional homestead compounds and mud architecture	125	83.3

Their declining use signals a transformation in social organization and community life due to modern societal changes. Sacred rivers and streams were noted by 114 respondents (76.0%), and spaces linked to traditional festivals by 113 (75.3%). These figures suggest that pollution, soil erosion, urban sprawl, and reduced participation in cultural festivals are endangering environmentally and culturally meaningful sites. Traditional burial grounds and ancestral cemeteries were flagged by 111 respondents (74.0%), while traditional farming terraces and farmlands were mentioned by 110 (73.3%). These trends reflect growing land commodification, population demands, and shifts in agricultural practices that erode ancestral land-use traditions and

heritage locations. Traditional marketplaces were identified as vulnerable by 109 respondents (72.7%), and masquerade performance areas by 106 (70.7%), indicating that upgrades in commercial infrastructure and fading cultural practices are diminishing spaces once central to local economies and artistic expression. Sites associated with traditional rulers' palaces received 104 mentions (69.3%), and historic community meeting grounds 102 (68.0%), pointing to weakening traditional authority systems and limited efforts to preserve historically important communal spaces. Indigenous craft and blacksmithing sites were recognized as endangered by 99 respondents (66.0%), and ancient footpaths and trade routes by 97 (64.7%). These declines are likely driven by industrialization,

modern transportation networks, and decreasing interest in traditional trades, threatening both artisanal knowledge and historical connectivity. Ancient boundary markers were the least frequently cited, with 92 responses (61.3%), yet still indicate notable concern over the loss of territorial identifiers due to land conflicts, urban growth, and environmental damage.

Overall, the results show that a wide range of Igbo cultural landscapes face growing threats from modernization, urban expansion, Western influence, environmental harm, religious transformation, and insufficient preservation initiatives. Comparable observations have also been reported by UNESCO (2019) and Akinyemi (2021).

Table 3. Extent of cultural identity crises linked to heritage loss among the Igbos of southeast Nigeria

Sl	Cultural Identity Crises Linked to Heritage Loss	Mean	SD	Decision
1	Decline in the use of indigenous Igbo language among youths	3.29	0.88	Accepted
2	Loss of respect for traditional values and customs	3.23	0.86	Accepted
3	Reduced participation in traditional festivals and ceremonies	3.25	0.91	Accepted
4	Identity confusion among younger generations	3.24	0.83	Accepted
5	Preference for western lifestyles over indigenous practices	3.32	0.92	Accepted
6	Weak attachment to ancestral heritage and history	3.23	0.87	Accepted
7	Declining interest in traditional occupations and crafts	3.19	0.85	Accepted
8	Increased abandonment of traditional dressing and symbols	3.23	0.90	Accepted
9	Erosion of communal values and kinship relationships	3.25	0.90	Accepted
10	Gradual disappearance of indigenous religious beliefs	3.31	0.88	Accepted

Table 4. Role of geographic information systems (GIS) in preserving and managing Igbo cultural heritage sites

Sl	Roles of GIS in preserving and managing Igbo cultural heritage sites	Frequency	Percentage
1	Mapping and documentation of cultural heritage sites	132	88.0
2	Monitoring environmental threats to heritage sites	124	82.7
3	Digital preservation of indigenous cultural landscapes	119	79.3
4	Identification of endangered heritage locations	121	80.7
5	Supporting cultural tourism development	108	72.0
6	Assisting land-use planning around heritage sites	113	75.3
7	Enhancing disaster risk management for heritage areas	105	70.0
8	Providing spatial databases for cultural resources	126	84.0
9	Facilitating heritage site inventory and archiving	117	78.0
10	Promoting informed decision-making for heritage conservation	122	81.3
11	Tracking urban encroachment on cultural landscapes	111	74.0
12	Supporting community participation in heritage management	102	68.0
13	Improving accessibility to heritage information	109	72.7
14	Assisting researchers in cultural and historical studies	115	76.7
15	Preserving sacred forests and traditional boundaries through spatial analysis	118	78.7

Extent of cultural identity crises linked to heritage loss among the Igbos

Table 3 assessed the impact of heritage loss on cultural identity among the Igbo people of Southeast Nigeria using a four-point Likert scale. All survey items yielded mean scores exceeding the 2.50 threshold, indicating broad agreement that the erosion of cultural heritage has played a significant role in identity-related challenges within the community. Among the surveyed statements, "Preference for western lifestyles over indigenous practices" received the highest average score at 3.32, with a standard deviation of 0.92. This supports the findings of Ugwuoke (2019), who reported that increasing adoption of Western lifestyles has

weakened indigenous identity among many Igbo youths. Similar concerns have also been highlighted by UNESCO (2003). This suggests a strong perception that the adoption of Western norms has led to the decline of traditional customs, weakening the foundations of Igbo cultural identity. The low variation in responses indicates a high degree of consensus among participants. Similarly, the statement addressing the "Gradual disappearance of indigenous religious beliefs" achieved a mean of 3.31 and a standard deviation of 0.88, reflecting widespread concern that the fading of native spiritual systems is undermining cultural continuity and contributing to identity instability. The item on "Decline in the use of

indigenous Igbo language among youths” recorded a mean of 3.29 and a standard deviation of 0.88, highlighting agreement that reduced language use by younger generations threatens the preservation of cultural identity and intergenerational transmission of heritage. Two additional factors—“Reduced participation in traditional festivals and ceremonies” and “Erosion of communal values and kinship relationships”—both averaged 3.25. These results point to a perceived weakening of social bonds and diminished engagement in collective cultural practices, which in turn affects the passing down of cultural values. The statement on “Identity confusion among younger generations” scored 3.24 with a standard deviation of 0.83, indicating that many respondents believe young Igbos face difficulties reconciling modern influences with traditional cultural expectations. Items related to “Loss of respect for traditional values and customs,” “Weak attachment to ancestral heritage and history,” and “Increased abandonment of traditional dressing and symbols” each had mean scores of 3.23. These findings reflect a shared view that cultural norms, historical awareness, and symbolic expressions are increasingly being overlooked in present-day Igbo society. The lowest mean score was recorded for “Declining interest in traditional occupations and crafts” at 3.19, with a standard deviation of 0.85. While this was the least emphasized factor, it still surpassed the benchmark, showing that respondents still regard it as a meaningful contributor to cultural identity challenges. The overall grand mean of 3.25 underscores a strong collective agreement that heritage loss has significantly affected cultural identity among the Igbo. These findings are consistent with previous studies linking language decline and reduced participation in traditional practices with weakening cultural identity (Nwaka, 2020; Ugwuoke, 2019). With an average standard deviation of 0.88, responses were consistently aligned, indicating a uniformity of perspective across participants. The results highlight that the diminishing presence of cultural heritage has far-reaching consequences for language, belief systems, communal ties, traditional practices, and the sense of self within Igbo society.

Role of geographic information systems (GIS) in preserving and managing Igbo cultural heritage sites

Table 4 outlines respondents’ perspectives on how Geographic Information Systems (GIS) contribute to the preservation and management of Igbo cultural heritage sites in Southeast Nigeria. Because participants could select more than one role, the total number of responses surpassed the 150 individuals surveyed. Mapping and documenting heritage sites emerged as the most widely recognized function, chosen by 132 respondents (88.0%), highlighting the perceived importance of GIS in precisely identifying, recording, and archiving cultural resources for future conservation efforts. This finding agrees with Longley *et al.* (2015), who demonstrated the effectiveness of GIS for spatial documentation and management of heritage resources, and with Goodchild (2007), who highlighted the importance of geospatial information for informed decision-making. Closely following, 126 respondents (84.0%) identified GIS as essential for creating spatial databases for cultural assets. This reflects its value in systematically storing, organizing, and accessing geographic data, which enhances the efficiency of heritage management. Monitoring environmental risks to heritage locations was acknowledged by 124 respondents (82.7%), while 122 (81.3%) emphasized its role in supporting informed conservation decisions. These results suggest that GIS is seen as effective in tracking threats such as erosion, flooding, deforestation, and urban development, while also providing reliable data to guide policy and conservation strategies. Identifying heritage sites at risk of damage or loss was selected by 121 respondents (80.7%), indicating that GIS can help prioritize vulnerable locations for timely protective measures and planning. Digital preservation of indigenous cultural landscapes received 119 responses (79.3%), and using spatial analysis to protect sacred forests and traditional boundaries was noted by 118 (78.7%). These findings point to GIS’s usefulness in safeguarding culturally significant areas from encroachment through digital documentation and boundary mapping. A total of 117 respondents (78.0%) recognized GIS’s role in facilitating the inventory and archiving of heritage

sites, while 115 (76.7%) saw it as beneficial for academic research in cultural and historical studies. This underscores its contribution to systematic documentation and scholarly inquiry into cultural heritage. GIS support for land-use planning near heritage sites was acknowledged by 113 respondents (75.3%), and tracking urban expansion into cultural areas was cited by 111 (74.0%), suggesting its importance in balancing development with the protection of culturally important spaces. Improving access to heritage information was identified by 109 respondents (72.7%), and promoting cultural tourism development was selected by 108 (72.0%), indicating that GIS helps disseminate knowledge to researchers, planners, tourists, and local communities, thereby supporting tourism initiatives. Disaster risk management for heritage zones was recognized by 105 respondents (70.0%), showing that GIS aids in anticipating and responding to environmental hazards like floods and landslides that could endanger cultural sites. Community involvement in heritage management was the least cited role, with 102 responses (68.0%). Nonetheless, this still indicates that GIS supports local engagement by equipping communities with spatial tools and information to monitor and protect their cultural assets. Overall, the results show that GIS plays a multifaceted and vital role in documenting, monitoring, preserving, and sustainably managing Igbo cultural heritage. Similar applications of GIS for cultural heritage management have been documented by Akinyemi (2021) and Longley *et al.* (2015). The study concludes that GIS technology holds strong potential as a tool for countering cultural erosion and ensuring the long-term survival of indigenous heritage in Southeast Nigeria.

Contributions of remote sensing and digital mapping in monitoring disappearing cultural landscapes in southeast Nigeria

Table 5 outlines respondents' perspectives on how remote sensing and digital mapping contribute to monitoring vanishing cultural landscapes in Southeast Nigeria. Because participants could select multiple options, the total number of responses

surpassed the 150 individuals surveyed. Change detection in cultural landscapes over time emerged as the most recognized benefit, selected by 129 respondents (86.0%). This supports previous research demonstrating that remote sensing provides reliable long-term monitoring of environmental and cultural landscape changes (Akinyemi, 2021; Longley *et al.*, 2015). This indicates a strong belief that these technologies are effective in tracking and analyzing shifts in cultural environments, which in turn supports conservation initiatives. Monitoring changes in land use and land cover followed closely, with 127 responses (84.7%), while identifying at-risk heritage sites received 126 responses (84.0%).

These results highlight the importance of geospatial tools in detecting transformations in land use, vegetation, and site conditions, allowing for timely actions to prevent further loss. Tracking urban encroachment into heritage zones was noted by 124 respondents (82.7%), and monitoring deforestation near sacred forests and groves was cited by 123 (82.0%). This reflects a view that remote sensing is valuable for observing human-driven threats like urbanization and forest loss that endanger culturally significant areas. Providing accurate spatial data for heritage management received 122 responses (81.3%), and mapping erosion and environmental degradation in heritage zones was selected by 121 respondents (80.7%). These findings suggest that digital mapping improves access to reliable geographic information crucial for managing and protecting cultural and ecological resources.

Supporting conservation planning was acknowledged by 120 respondents (80.0%), and early threat detection by 119 (79.3%), indicating that these technologies aid in proactive decision-making and risk assessment for safeguarding cultural landscapes. Documentation of disappearing traditional settlements was identified by 118 respondents (78.7%), and creating digital archives for cultural landscapes by 116 (77.3%), underscoring the role of digital tools in preserving visual and spatial records of endangered heritage. Preserving historical and

archaeological data received 114 responses (76.0%), and assisting researchers in cultural heritage studies was selected by 111 (74.0%), showing that these technologies support academic inquiry and documentation of indigenous heritage. Enhancing cultural tourism through digital mapping was recognized by 105 respondents (70.0%), suggesting that such tools help promote tourism by making heritage sites more visible and accessible. Finally, supporting community awareness and involvement in heritage protection was the least cited contribution,

with 103 responses (68.7%). While it ranked lowest, this still indicates that these technologies contribute to public engagement and local participation in preservation efforts. Overall, the results show that remote sensing and digital mapping are seen as vital for monitoring cultural landscape loss in Southeast Nigeria. They are viewed as key tools for identifying environmental and human-induced changes, maintaining digital records, guiding conservation strategies, and supporting sustainable stewardship of cultural heritage among the Igbo people.

Table 5. Contributions of remote sensing and digital mapping in monitoring disappearing cultural landscapes in southeast Nigeria

Sl Contributions of remote sensing and digital mapping	Frequency	Percentage
1 Detection of changes in cultural landscapes over time	129	86.0
2 Monitoring deforestation around sacred forests and groves	123	82.0
3 Identification of endangered heritage sites	126	84.0
4 Mapping erosion and environmental degradation affecting heritage areas	121	80.7
5 Documentation of disappearing traditional settlements	118	78.7
6 Tracking urban expansion into cultural heritage zones	124	82.7
7 Creation of digital archives for cultural landscapes	116	77.3
8 Supporting heritage conservation planning	120	80.0
9 Monitoring land-use and land-cover changes	127	84.7
10 Providing accurate spatial data for heritage management	122	81.3
11 Preservation of historical and archaeological information	114	76.0
12 Enhancing cultural tourism through digital mapping	105	70.0
13 Assisting researchers in cultural heritage studies	111	74.0
14 Early detection of threats to cultural landscapes	119	79.3
15 Supporting community awareness and participation in heritage protection	103	68.7

Role of geoinformatics in preserving indigenous languages and cultural identity among the Igbo people

Table 6 outlines respondents' perspectives on how geoinformatics contributes to safeguarding indigenous languages and cultural identity among the Igbo people in Southeast Nigeria. Because participants could select multiple roles, the total number of responses surpasses the 150 individuals surveyed. Digital documentation of indigenous language materials emerged as the most widely recognized function, selected by 131 respondents (87.3%). This finding supports UNESCO (2011), which emphasized digital documentation as an effective strategy for safeguarding endangered languages. Similar observations were reported by Ugwuoke (2019). This highlights a strong belief in the value of geoinformatics for digitally preserving linguistic resources, helping to prevent language loss and sustain cultural heritage over time. Recording and archiving traditional place names

was cited by 127 respondents (84.7%), while creating digital maps of cultural heritage sites was noted by 126 (84.0%). These results point to the importance of geospatial tools in maintaining geographic and cultural identities and ensuring that heritage knowledge is passed on. Mapping culturally significant communities was identified by 124 respondents (82.7%), and protecting at-risk linguistic and cultural assets was selected by 123 (82.0%). This reflects a perception of geoinformatics as a valuable means of identifying vulnerable cultural areas and aiding conservation efforts. Monitoring the decline of cultural and linguistic landscapes received 122 responses (81.3%), and preserving sacred sites linked to indigenous identity was mentioned by 121 (80.7%). These responses suggest that geospatial technologies help track environmental and societal changes that threaten cultural landscapes and spiritually important locations.

Table 6. Role of geoinformatics in preserving indigenous languages and cultural identity among the Igbo people

Sl Roles of geoinformatics in preserving indigenous languages and cultural identity	Frequency	Percentage
1 Digital documentation of indigenous language resources	131	87.3
2 Mapping locations of culturally significant communities	124	82.7
3 Preservation of oral traditions through geospatial databases	120	80.0
4 Recording and archiving indigenous place names	127	84.7
5 Supporting cultural education and awareness programs	118	78.7
6 Monitoring disappearing cultural and linguistic landscapes	122	81.3
7 Promoting accessibility to indigenous cultural information	115	76.7
8 Enhancing research on indigenous language distribution	119	79.3
9 Preservation of sacred sites associated with indigenous identity	121	80.7
10 Assisting policymakers in cultural heritage management	111	74.0
11 Creating digital maps of cultural heritage resources	126	84.0
12 Supporting intergenerational transmission of cultural knowledge	117	78.0
13 Protecting endangered linguistic and cultural resources	123	82.0
14 Enhancing community participation in heritage preservation	109	72.7
15 Promoting cultural tourism and indigenous identity awareness	105	70.0

Preserving oral traditions using geospatial databases was selected by 120 respondents (80.0%), while improving research on the distribution of indigenous languages was noted by 119 (79.3%).

This indicates that such technologies support the recording of oral histories and enhance scholarly analysis of language and cultural patterns. Supporting cultural education and awareness initiatives were identified by 118 respondents (78.7%), and facilitating the intergenerational transfer of cultural knowledge by 117 (78.0%). These findings imply that geoinformatics aids in teaching younger generations about their linguistic and cultural heritage. Improving access to indigenous cultural information was selected by 115 respondents (76.7%), and assisting policymakers in managing cultural heritage was noted by 111 (74.0%). This suggests that geospatial data enhances public access to cultural knowledge and supports informed

decision-making in heritage planning. Encouraging community involvement in heritage preservation was recognized by 109 respondents (72.7%), indicating that these technologies help empower local populations to take an active role in protecting their cultural legacy. Promoting cultural tourism and raising awareness of indigenous identity received the fewest responses, with 105 (70.0%).

While this was the least emphasized role, it still shows that geoinformatics can contribute to tourism development and broader public recognition of Igbo cultural values. The results show that geoinformatics plays a vital role in preserving Igbo language and culture. It supports digital archiving, cultural mapping, heritage protection, language conservation, community engagement, and educational outreach, all of which help reduce the risk of cultural erosion and loss in Southeast Nigeria.

Table 7. Suggested geospatial and technological strategies for improving cultural heritage conservation and management in southeast Nigeria

Sl Suggested Strategies	Frequency	Percentage
1 Use of GIS mapping for documenting cultural heritage sites	132	88.0
2 Application of remote sensing technologies for monitoring heritage landscapes	118	78.7
3 Creation of digital archives for indigenous languages, artifacts, and traditions	140	93.3
4 Development of mobile apps for cultural education and awareness	109	72.7
5 Use of drones for heritage site surveillance and monitoring	96	64.0
6 Establishment of geospatial databases for cultural resources management	124	82.7
7 Integration of cultural heritage data into web-based GIS platforms	102	68.0
8 Adoption of 3D scanning and virtual reality technologies for preservation	87	58.0
9 Use of social media and digital storytelling for cultural promotion	126	84.0
10 Government investment in ICT and geoinformatics infrastructure for heritage conservation	136	90.7

Multiple Responses, n = 150

Geospatial and technological strategies for improving cultural heritage conservation and management in southeast Nigeria

Table 7 outlines respondents' views on various geospatial and technological approaches that could enhance the conservation and management of cultural heritage in Southeast Nigeria.

Because participants could choose multiple options, the total number of responses surpasses the sample size of 150. Digital archiving of indigenous languages, artifacts, and traditions received the highest level of support, with 140 respondents (93.3%) selecting it. This finding is consistent with UNESCO (2019), which recommends digital documentation as a core strategy for safeguarding cultural heritage. Goodchild (2007) also emphasized the value of geospatial databases for effective resource management. This reflects a strong consensus that digitizing cultural materials is vital for protecting endangered heritage and ensuring that traditional knowledge remains available to future generations. Such archiving plays a key role in safeguarding oral histories, folklore, historical accounts, and physical artifacts from being lost over time. Government investment in ICT and geoinformatics infrastructure was the second most supported measure, chosen by 136 respondents (90.7%). This highlights the belief that institutional backing, financial commitment, and technological advancement are essential for long-term, effective heritage preservation. Without proper infrastructure and supportive policies, even well-intentioned digital efforts may fail to deliver results. A total of 132 respondents (88.0%) identified GIS mapping as a valuable method for recording cultural heritage sites. Geographic Information Systems are widely seen as effective tools for locating and managing cultural assets such as sacred forests, shrines, archaeological zones, and ancestral settlements.

Their use can significantly improve planning and conservation strategies. Social media and digital storytelling were selected by 126 respondents (84.0%) as useful for promoting cultural heritage. This suggests growing recognition of digital platforms in engaging younger audiences and fostering broader cultural

participation, both within local communities and across international networks. Establishing geospatial databases for managing cultural resources was supported by 124 respondents (82.7%), indicating a preference for centralized, organized digital systems that allow efficient storage, access, and use of cultural data—capabilities that can strengthen policy development and decision-making. Remote sensing technologies, such as satellite imagery, were acknowledged by 118 respondents (78.7%) as important for monitoring changes in heritage landscapes. These tools are seen as effective in detecting environmental risks, shifts in land use, and unauthorized encroachments on culturally significant areas. Mobile applications for cultural education were backed by 109 respondents (72.7%), reflecting an understanding that smartphone-based tools can support informal learning and increase engagement, particularly among youth who are already immersed in digital environments.

Integrating cultural heritage data into web-based GIS platforms was supported by 102 respondents (68.0%), pointing to a demand for accessible, interactive online systems that enable public and institutional users to explore and manage cultural information remotely. Drones were selected by 96 respondents (64.0%) as a means of monitoring and securing heritage sites. Their ability to reach remote or difficult-to-access locations makes them valuable for surveillance, environmental assessment, and data gathering. 3D scanning and virtual reality technologies received the fewest selections, with 87 respondents (58.0%) in favor. While this is the lowest level of support, it still represents considerable approval. The relatively lower response may stem from perceptions of high costs or limited accessibility, despite the proven potential of these technologies in digitally preserving monuments and artifacts. In all, the results show strong endorsement for incorporating geospatial tools, digital platforms, and ICT innovations into cultural heritage protection efforts in Southeast Nigeria. The study underscores the increasing role of technologies like GIS, remote sensing, digital archives, and online systems in preventing cultural loss and advancing more effective, modern management practices.

CONCLUSION

The study found that geoinformatics is crucial in tackling the increasing threats to the cultural heritage of the Igbo people in southeastern Nigeria, including the loss of languages, cultural practices, traditional landscapes, and historical sites. It showed that tools such as GIS, remote sensing, and spatial data technologies offer a structured approach to recording, tracking, and protecting both physical and non-physical cultural elements. Results indicate that numerous Igbo heritage locations are either not documented or inadequately managed, leaving them at risk from urban development, environmental damage, and lack of attention. Geoinformatics, however, presents effective solutions by supporting the development of digital cultural records, precise mapping of heritage areas, and ongoing monitoring of cultural environments. These methods help safeguard not only monuments and sites but also oral traditions, local knowledge systems, and linguistic diversity. As a result, the study emphasizes the importance of incorporating geoinformatics into heritage management strategies for long-term preservation. It calls for improved cooperation among government bodies, research institutions, and local communities to enhance data gathering, build technical expertise, and enforce relevant policies. In the long run, using geoinformatics can play a key role in maintaining the cultural identity of the Igbo people for current and future generations.

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