DOI: https://doi.org/10.34069/AI/2024.76.04.14
How to Cite:
Golkarian, S. (2024). Conserving Palmyra's Ancient Heritage: Challenges, Strategies, and Innovative Solutions. *Amazonia Investiga*, *13*(76), 173-187. https://doi.org/10.34069/AI/2024.76.04.14

Conserving Palmyra's Ancient Heritage: Challenges, Strategies, and Innovative Solutions

Palmyra'nın Kadim Mirasını Korumak: Zorluklar, Stratejiler ve Yenilikçi Çözümler

Received: March 1, 2024 Accepted: April 25, 2024

Written by:
Shabnam Golkarian[1]
https://orcid.org/0000-0002-1858-0133

Abstract

The ongoing conflict in Syria has inflicted significant damage on the cultural heritage of Palmyra, with monuments, temples, and tombs severely destroyed or damaged, and valuable artifacts lost due to looting and illegal excavation. Inadequate funding, resources, and a lack of a legal framework for heritage protection exacerbate the situation. This article explores various conservation strategies to address these issues, including international cooperation, documentation and mapping of archaeological sites, community engagement, and the establishment of a legal framework for heritage protection. Case studies of successful conservation projects offer valuable insights into effective strategies for preserving cultural heritage in conflict-affected areas. Additionally, the integration of artificial intelligence (AI) presents promising solutions for heritage conservation. AI technologies can assist in documenting and mapping archaeological sites, assessing damage, predicting future threats, and creating virtual reconstructions of destroyed heritage buildings. This study aims to analyze the obstacles in conserving Palmyra's heritage buildings during the Syrian conflict and propose effective strategies for conservation. The research addresses challenges such as conflict, looting, inadequate resources, and the lack of a legal framework for heritage protection. Preserving Palmyra's ancient heritage is crucial for humanity's cultural legacy. Despite these challenges, the international community, local stakeholders, and innovative technologies offer hope for restoration and preservation.

Özet

Suriye'de devam eden çatışma, Suriyenin tarihi bölgesi olan Palmira'nın kültürel mirasına önemli zararlar verdi; anıtlar, tapınaklar ve mezarlar ciddi şekilde tahrip edildi veya hasar gördü, değerli eserler yağma ve yasadışı kazı nedeniyle tahrip olup kaybedildi. Yetersiz fon ve kaynaklar ve mirasın korunmasına yönelik yasal çerçevenin olmayışı durumu daha da kötüleştiriyor. Bu nedenle bu makale, uluslararası işbirliği, arkeolojik alanların belgelenmesi ve haritalanması, topluluk katılımı ve mirasın korunmasına yönelik yasal bir çerçevenin oluşturulması dahil olmak üzere bu konulara değinen çeşitli koruma stratejilerini incelemektedir. Başarılı koruma projelerine ilişkin vaka çalışmaları, çatışmalardan etkilenen bölgelerde kültürel mirasın korunmasına yönelik etkili stratejiler konusunda değerli bilgiler sunmaktadır. Ek olarak, yapay zekanın (AI) Yapay Zeka entegrasyonu mirasın korunması için umut verici çözümler sunuyor. Yapay zeka teknolojileri, arkeolojik alanların belgelenmesine ve haritalandırılmasına, hasarın değerlendirilmesine, gelecekteki tehditlerin tahmin edilmesine ve yıkılan tarihi binaların sanal yeniden inşalarının oluşturulmasına yardımcı olabilir. Bu çalışma, Suriye çatışması sırasında Palmira'nın miras yapılarının korunmasındaki engelleri analiz etmeyi ve etkili koruma stratejileri önermeyi amaçlamaktadır. Araştırma çatışma, yağma, yetersiz kaynaklar ve mirasın korunmasına yönelik yasal bir çerçevenin bulunmaması gibi zorlukları ele alıyor. Palmira'nın antik mirasını korumak insanlığın kültürel mirası açısından hayati önem taşıyor. Bu zorluklara rağmen uluslararası

[1] Assist.Prof.Dr. Shabnam Golkarian, Department of Architecture, Near East University, Near East Boulevard, Nicosia, Turkey.
WoS Researcher ID: GZA-9671-2022

Keywords: Heritage Conservation, Palmyra, Cultural Heritage, AI, Innovative Conservation Strategies.

topluluk, yerel paydaşlar ve yenilikçi teknolojiler restorasyon ve koruma için umut veriyor.

Anahtar Kelimeler: Mirasın Korunması, Palmira, Kültürel Miras, Yapay Zeka, Yenilikçi Koruma Stratejileri.

Introduction

Syria, renowned for its rich cultural legacy, is home to numerous ancient archaeological sites, museums, and monuments. However, the ongoing conflict has severely impacted the country's heritage, with the ancient city of Palmyra suffering immensely. Palmyra, with its majestic Roman ruins, is a globally recognized archaeological treasure, offering an enthralling glimpse into the past. Located in central Syria, Palmyra has been the epicenter of the Syrian conflict since 2011, suffering extensive destruction when it was captured by the Islamic State of Iraq and Syria (ISIS) in May 2015. This devastation includes the deliberate destruction of monuments, temples, and tombs, coupled with widespread looting and illegal excavations, resulting in the loss of invaluable artifacts.

Protecting cultural heritage in conflict zones is a complex and challenging task. Historical data reveal a tragic pattern of targeted cultural heritage destruction, such as the Mostar Bridge in Bosnia and Herzegovina, the Bamiyan Buddhas in Afghanistan, and the mausoleums in Timbuktu, Mali, (Figure 1). These acts are not only aimed at erasing physical remnants of the past but also at destroying a people's cultural identity and history. This form of psychological warfare undermines a group's sense of identity and community, with far-reaching consequences for future generations. The destruction of cultural heritage often coincides with mass atrocities, including genocide, war crimes, crimes against humanity, and ethnic cleansing, aiming to erase both individuals and the cultural legacies that shape their identities.

As part of the development of the conflict in Syria, it is important to consider such an aspect of the "hybrid war" as information and psychological pressure on the opponent, (Mansurov & Krylov, 2018). Numerous international and local groups have taken preemptive steps to conserve and protect these priceless cultural assets in response to the threats facing Palmyra and other heritage sites in Syria. In organizing worldwide efforts to protect Syria's cultural legacy, UNESCO has been a key player. As defined by UNESCO, encompasses both tangible and intangible elements that are inherited from previous generations and are representative of a society's culture and way of life (Albayati & Alobaydi, 2023). In order to support local people and authorities in their conservation efforts, the organization has given vital support in the form of technical assistance, capacity-building programs, and emergency interventions (UNESCO). The Syrian government and local communities have taken steps to protect and preserve heritage sites despite the ongoing conflict and scarce resources (Intagliata, 2016).

Palmyra's significance extends beyond its historical and cultural legacy. It underscores the necessity of safeguarding the world's architectural heritage and maintaining our cultural memories. Innovative technologies, particularly artificial intelligence (AI), offer promising solutions for heritage conservation. AI can assist in documenting and mapping archaeological sites, assessing damage, predicting future threats, and creating virtual reconstructions of destroyed heritage buildings. AI platforms such as Midjourney and DALL-E 3 provide advanced tools for visualizing and reconstructing heritage sites, facilitating efforts to preserve and restore Palmyra's cultural treasures.

This article explores the obstacles and strategies for conserving Palmyra's ancient heritage amidst the Syrian conflict. It adopts a multidisciplinary approach, combining quantitative and qualitative data collection, to analyze the challenges and propose effective conservation strategies. By examining successful case studies and leveraging AI technologies, this study aims to provide practical solutions to preserve Palmyra's cultural legacy. The research addresses the critical need for international cooperation, community engagement, and the establishment of a robust legal framework for heritage protection, offering hope for the restoration and preservation of Palmyra's heritage for future generations, (Figure 2).

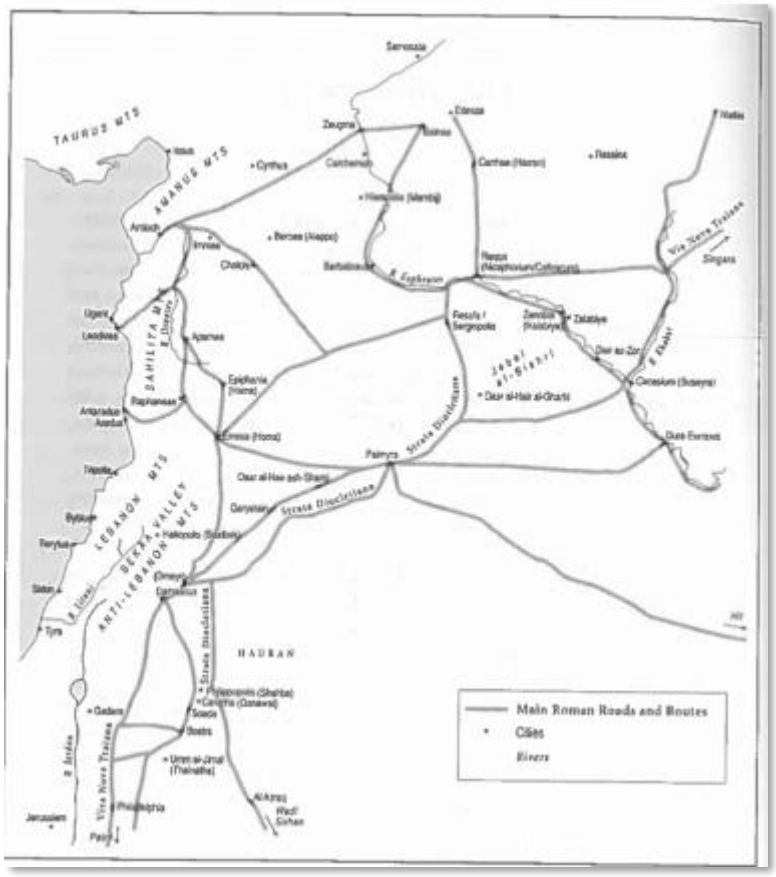

Figure 1. Map of Roman Syria.
Source: (Intagliata, 2016).

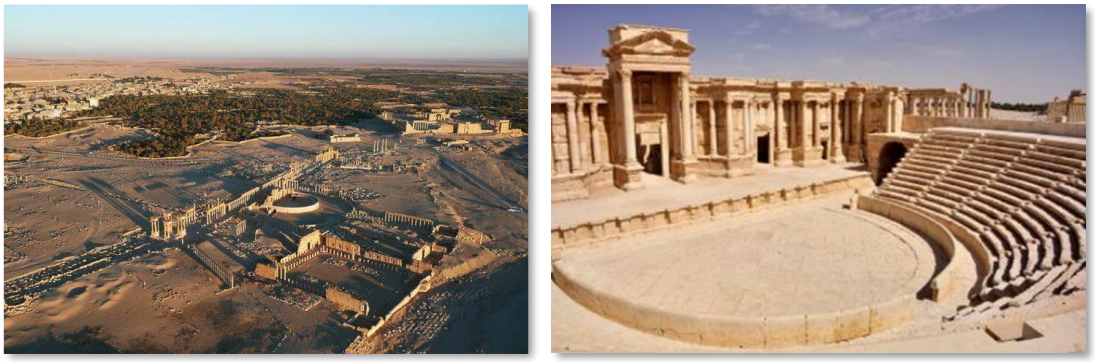

Figure 2. Palmyra before Destruction.
Source: (Intagliata, 2016).

The Importance of Palmyra: Palmyra's importance stems from its rich historical background and cultural legacy, which have drawn interest from various groups over the years. Destroying the historic buildings and cultural legacy of Palmyra emphasizes the necessity of safeguarding the world's architectural legacy and maintaining our cultural memories (Denker, 2022). The palmyra tree, which is towering and swinging and well-known for its many purposes, is also important to Indian agriculture. Farmers value the tree as a valuable resource because of the various uses for its fruit, leaves, and sap. In numerous places, such as Kerala, Tamil Nadu, Cambodia, and Indonesia, palmyra trees hold great cultural significance as emblems of their individual cultures (Jana & Jana, 2017). Palmyra is more important than its cultural and agricultural significance. In order for future generations to learn about and appreciate the artistic brilliance and resourcefulness of earlier civilizations, the relics of this city must be preserved. The use of intelligent reality in 3D visualization offers a new method of "post-

trauma reconstruction," which can help restore lost cultural assets (Denker, 2022), (Figure 3). A detailed analysis of the phytochemicals—the bioactive compounds found in spices—as immunomodulatory agents demonstrates the importance of these molecules. When creating goods that include spices, such as the Trikatu Syrup made from Palmyra palm neera, this calls for a thorough investigation into these bioactive. The historical background, cultural legacy, agricultural importance, and architectural significance of Palmyra all contribute to its relevance. Palmyra's ruins and cultural legacy must be preserved so that future generations might benefit from and enjoy them. The reconstruction and standardization of lost cultural heritage and spice-based formulations can be aided by the application of modern technologies such as NMR-based phytochemical profiling and 3D visualization with intelligent reality, (Figure 4).

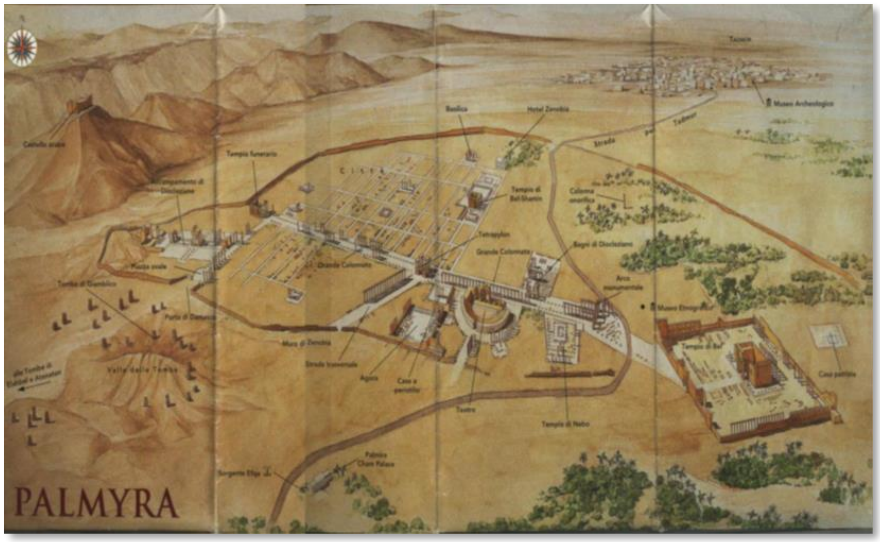

Figure 3. Palmyra tourist map (DGMA).
Source: (Arkawi, 2017).

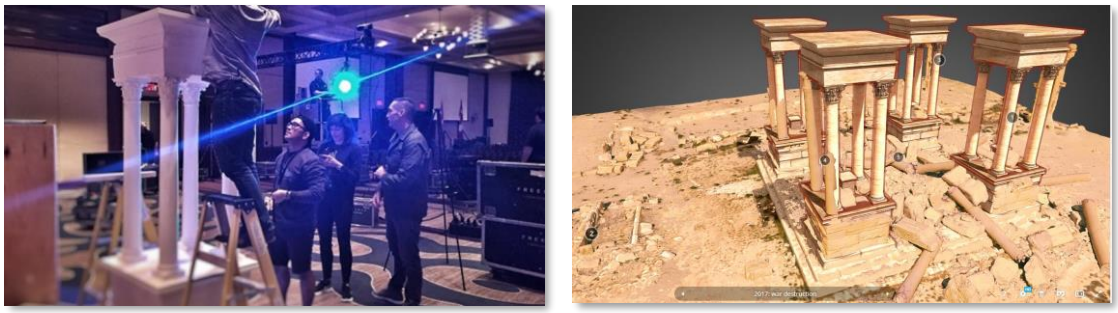

Figure 4. Installation of the three-dimensional model in Toronto. Iconem's virtual reconstruction.
Source: (Intagliata, 2016).

Heritage Conservation in Syria: Challenges and Context: The prolonged military conflict makes it extremely difficult to preserve Syria's cultural heritage, which has disastrous effects on the country's monuments and cultural assets. For the intention of eradicating the sense of community and collective memory of the populations to whom these heritage sites belong, militant militants, especially ISIS, have deliberately destroyed archeological sites, museums, historical landmarks, and local sanctuaries (Harmanşah, 2015), (Figure 5). These attacks aim to deprive the Syrian people of their identity, history, and knowledge, which is revealed by the methodical destruction of tangible cultural property from Syria. The nation's cultural legacy has not been well preserved by the current Syrian archaeological authority, the DGAM. Reconstruction initiatives for Syria's ancient heritage have been abandoned as a result of its deference to the ruling authorities and refusal to work with skilled Syrian professionals who left the country at the beginning of the crisis. The DGAM, the only

authority in Syria following ten years of fighting, is driving the "Syrian archaeological question" into a devastating cycle that is destroying its noble qualities, especially those related to "human archaeology" (Al-Maqdissi, 2020). The inability of archaeologists and cultural heritage experts to enter the conflict zone makes it difficult to adequately assess the damage and makes it more difficult to develop methods for effective mitigation. However, the use of modern, high-resolution satellite images for satellite-based monitoring has made it possible to record and assess damage to ancient sites in southern Turkey, northern Iraq, and Syria flexibly and effectively. In addition to providing a possible paradigm for upcoming remote sensing-based initiatives to monitor archaeological and cultural treasures in the Middle East and beyond, our method makes spatial and temporal inquiries easier (Casana & Laugier, 2017). As a result of the prolonged fighting, the devastation of historic sites, and the dubious actions of the current archaeological authority, Syria's cultural legacy is facing formidable challenges that must be overcome. In order to evaluate and safeguard cultural assets in Syria and other areas, remote sensing technologies—such as satellite-based monitoring—are crucial because access is restricted for experts on the ground.

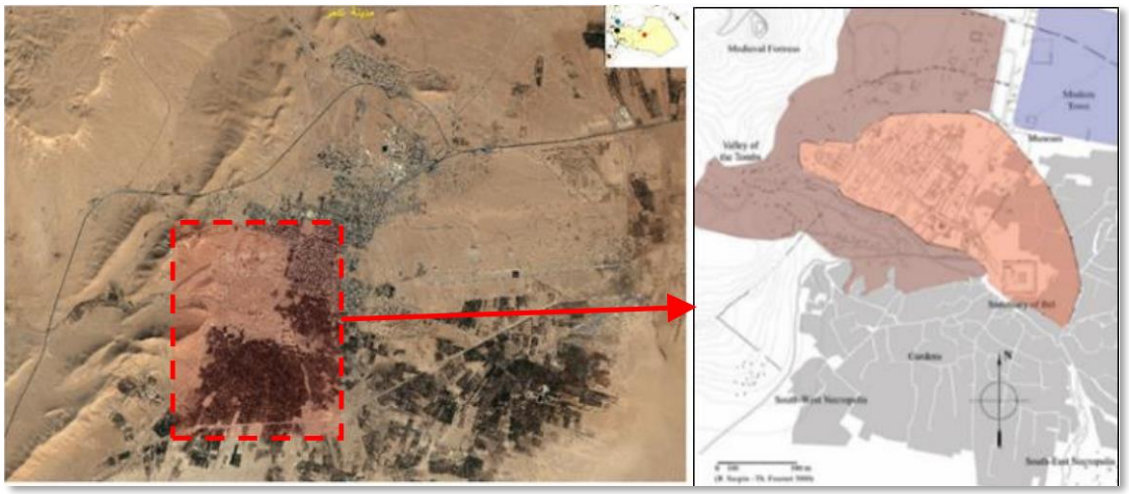

Figure 5. Site plan of Palmyra and the modern city GIS/ 2016 & the Site of Palmyra.
Source: (Casana & Laugier, 2017).

Theoretical Framework or Literature Review

Historical Significance of Palmyra and Its Cultural Heritage

The city of Palmyra in Syria is a valuable cultural heritage site known for its many historically significant structures (Arkawi, 2017). Due to its immense importance, the city was added to the national and international heritage registers in 1980. Palmyra was a center of regional trade and commerce and had a unique blend of Eastern, Western, and Indigenous artistic traditions in its art and architecture (Ibrahim, 2020). Unfortunately, the Syrian conflict caused significant damage to Palmyra, destroying buildings like the Castle, the Arch of Triumph, the Temple of Ba'al, and the Temple of Bael-Shameen (Arkawi, 2017), (Figure 6). The people of the city were forced to leave, and Palmyra's reputation as an oasis was lost. Aleppo, another well-known cultural heritage site in Syria, is one of the world's oldest continuously inhabited towns and became a World Heritage City in 1986 (Ibrahim, 2020). Aleppo also suffered significant damage during the Syrian crisis. In conclusion, Aleppo and Palmyra, with their significant cultural heritage value, have both faced substantial destruction due to the Syrian conflict. The destruction has led to the relocation of local populations, and effective institutions are required to handle the complex conservation issues that arise following such conflicts.

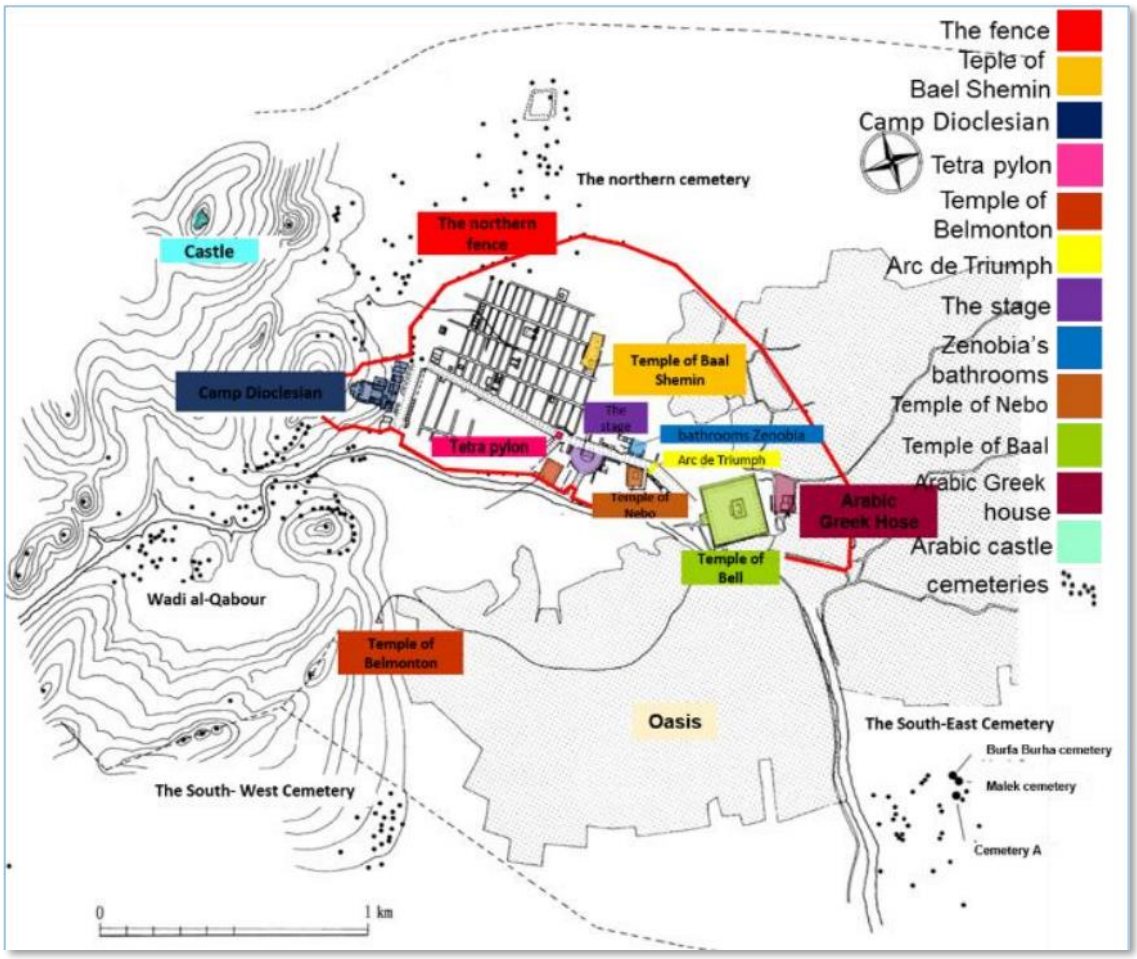

Figure 6. The main monuments in Palmyra's site.
Source: (Intagliata, 2016).

Challenges to Heritage Conservation in Conflict Zones

Conserving heritage in conflict zones poses major challenges, including the impact of conflict on architectural heritage, balancing preservation with economic considerations, and the clash between traditional landscapes and imposed preservation strategies. Inflexible preservation strategies imposed on traditional cultural landscapes can disrupt the harmonious relationship between these landscapes and the preservation approaches, leading to negative consequences for both management and local communities.

Balancing heritage preservation with economic considerations requires the sustainable utilization of heritage resources. However, overlapping organizational structures complicate conservation efforts, leading to coordination issues and hindering effective decision-making and implementation. To overcome these challenges, it is essential to develop adaptive strategies that balance heritage preservation with the needs of local communities and the broader socio-economic context.

Several initiatives have been taken to protect cultural heritage in Syria. One notable effort is the Protect and Preserve Cultural Property Act proposed in the United States, aiming to establish a coordinator and committee responsible for cultural heritage preservation efforts (Fincham, 2015). UNESCO has been actively involved in preserving Syrian cultural heritage, designating six World Heritage sites in Syria as being in danger in 2013 (Arkawi, 2017). The organization has called for increased efforts to safeguard Syrian heritage and condemned the destruction of the Tetrapylon and extensive damage to the Theatre in Palmyra, both UNESCO World Heritage sites. Additionally, a workshop focused on Palmyra was organized to envision the reconstruction and revival of this historically significant site, incorporating new ideas and technology (Arkawi, 2017).

Strategies for Heritage Conservation in Conflict Zones

"Preserving cultural heritage in conflict zones requires a comprehensive strategy to address the damage caused by war and conflict. One effective approach involves using satellite imagery to monitor archaeological sites and assess the impact of conflict. This method helps determine the extent of damage and develop mitigation strategies and policies to protect cultural heritage. For example, a collaborative project between the American Schools of Oriental Research and the US Department of State used satellite imagery to track damage to archaeological sites in Syria, northern Iraq, and southern Turkey. The project developed a flexible and efficient methodology for documenting damage, enabling spatial and temporal queries that reveal unexpected patterns in damage severity, timing, and location (Casana & Laugier, 2017).

Digital tools and techniques offer another avenue for heritage preservation. 3D visualization facilitated by Intelligent Reality allows for modeling and reconstructing lost heritage. This method can be applied to resurrect the vanished heritage of Palmyra, which suffered destruction during the Syrian conflict (Denker, 2022). Considering heritage as a stabilizing element within these territories makes it possible to transform initial clashes into strategies that can serve as guiding principles for resolving regional heritage conflicts (Pages Madrigal, 2021).

Engaging local communities is vital for effectively managing monuments and preserving cultural heritage. Protecting cultural heritage is closely intertwined with improving residents' quality of life, reinforcing their sense of identity, and fostering stronger bonds with their place of residence. Consequently, facilitating collaboration between authorities and local communities is essential for achieving sustainable development goals in heritage conservation (Ćwik, 2020).

The Impact of Armed Conflict on Cultural Heritage In Syria

Due to the inaccessibility of conflict zones, accurately assessing the extent of damage has been challenging for heritage specialists and archaeologists. However, a collaborative project involving the American Schools of Oriental Research (ASOR) and the US Department of State has used advanced satellite imagery to monitor and evaluate damage to archaeological sites in Syria, northern Iraq, and southern Turkey. This extensive analysis, covering nearly 5000 sites, has revealed unexpected patterns regarding the damage's timing, severity, and locations, contributing to a better understanding of the evolving cultural heritage crisis in the region (Casana & Laugier, 2017).

During the conflict, the Directorate-General of Antiquities and Museums (DGAM) in Syria has played a negative role in preserving the country's national heritage. Its subordination to the current powers and reluctance to cooperate with qualified Syrian experts who emigrated at the beginning of the crisis has resulted in the abandonment of reconstruction projects for ancient Syrian heritage. As the sole authority in Syria after a decade of conflict, the DGAM's actions have led to the deterioration of the "Syrian archaeological question," causing significant damage and the loss of its inherent values, including those related to "human archaeology" (Al-Maqdissi, 2020), (Figure 7).

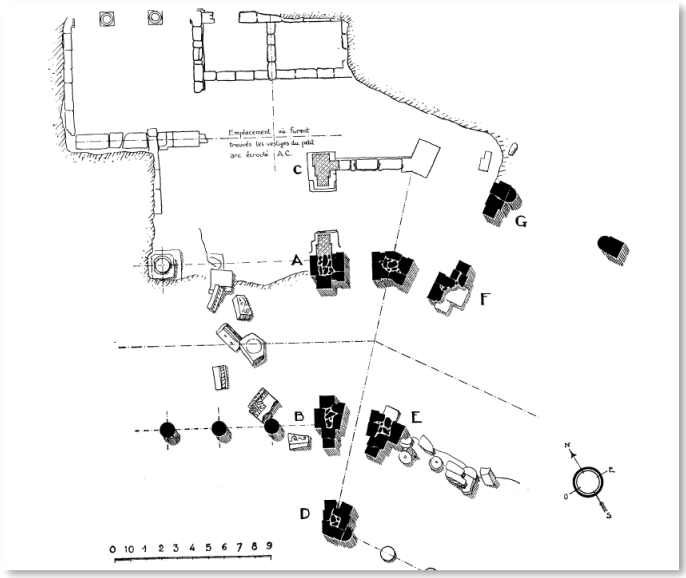

Figure 7. The monumental arch plan – marked with alphabet for restoration work. Source: (Amy, 1993).

Assessing the damage to buildings, structures, and cultural heritage items in the historic cities of Syria has relied on qualitative values. This approach helps evaluate the condition of the cultural environment, available resources, and valuable assets within historical centers. The developed approach includes prerequisites and a range of instruments to formulate reconstruction strategies for areas affected by military operations. It also entails urban development programs to stimulate cultural processes that can positively impact urban and regional economies (Shcherbina et al., 2020).
In order to evaluate the state of the cultural environment and provide the foundation for urban zoning and preservation plans, qualitative assessments of the damage to buildings, structures, and cultural heritage items are crucial (Rasoolimanesh & Jaafar, 2016), (Al-Maqdissi, 2020). These evaluations can also direct urban development initiatives and reconstruction plans that support regional economies, creating jobs, and resuming traditional crafts (Shcherbina et al., 2020). Conducting precise damage assessments has been difficult due to the unavailability of war zones. However, high-resolution satellite imagery has been used in cooperative initiatives including institutions such as the US Department of State and the American Schools of Oriental Research (ASOR) to monitor and assess damage to ancient sites in southern Turkey, northern Iraq, and Syria. By exposing unanticipated patterns of destruction and guiding upcoming remote sensing-based monitoring activities in the area, this creative technique has greatly contributed to our understanding of the dynamic cultural heritage situation (Casana & Laugier, 2017).

Utilizing AI Technology for Heritage Conservation

Artificial intelligence (AI) is emerging as a powerful tool in the fight to preserve our heritage for future generations. In addition to conventional conservation strategies, the integration of artificial intelligence (AI) technologies is a promising way to address the conservation challenges of Palmyra's ancient heritage buildings. Artificial intelligence offers innovative solutions that can complement existing efforts and increase the effectiveness of heritage conservation initiatives. AI could help advance national interests, such as economic prosperity, educational opportunities, quality of life, and national and internal security (Ryzheva et al., 2024).

Here are some ways to use artificial intelligence in heritage conservation:

- Artificial intelligence for documentation and mapping: Artificial intelligence-based techniques, such as computer vision and machine learning algorithms, are used to simplify the documentation and mapping of Palmyra's archaeological sites. These technologies can analyze vast amounts of data from satellite images and aerial photographs to create accurate maps and digital reconstructions of heritage buildings.
- Artificial intelligence for damage assessment: Implementation of artificial intelligence algorithms to assess and monitor damage to Palmyra's heritage buildings during conflicts. By analyzing

images and data collected from drones or satellites, AI systems can accurately identify areas of degradation and track changes over time, enabling timely conservation interventions.

- Artificial intelligence for predictive modeling: Use AI predictive capabilities to predict potential threats to Palmyra's cultural heritage, such as environmental degradation or the risk of further conflict. By analyzing historical data and current trends, AI algorithms can predict risks and help formulate proactive protection strategies to mitigate them.
- Artificial intelligence for virtual reality (VR) and augmented reality (AR): Explore using artificial intelligence-based virtual reality and augmented reality technologies to create immersive experiences that engage and educate people about Palmyra's cultural heritage. Virtual tours and interactive exhibits using artificial intelligence can increase public awareness and appreciation and foster support for conservation efforts (Figure 8) (Figure 9).

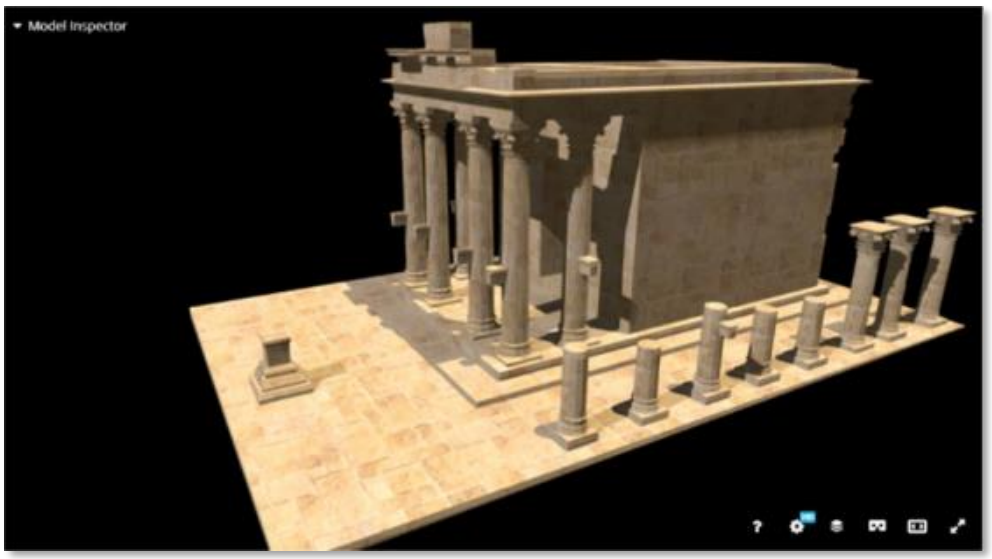

Figure 8. Still of a virtual reconstruction of the Temple of Baalshamin.
Source: (Intagliata, 2016).

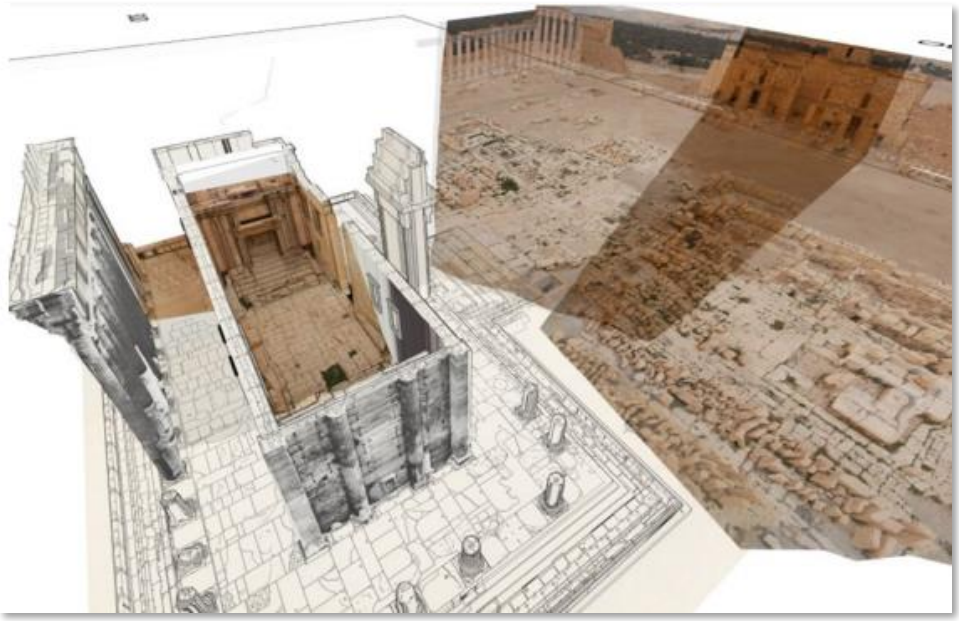

Figure 9. Virtual reconstruction of the Temple of Bel, showing internal and external views.
Source: (Intagliata, 2016).

Please remember the text below. TEXT:

- Artificial intelligence for protection policies and decision-making: Artificial intelligence technologies can provide valuable insights into the effectiveness of conservation strategies, optimize resource allocation, and inform evidence-based policies to preserve Palmyra's ancient heritage.
- Digitization and documentation: Artificial intelligence can automate the digitization of large amounts of cultural artifacts and archives. It includes high-quality scanning, 3D modeling, and image recognition for faster processing. It not only preserves these items digitally but also allows researchers and the public to access them remotely (Figure 10).

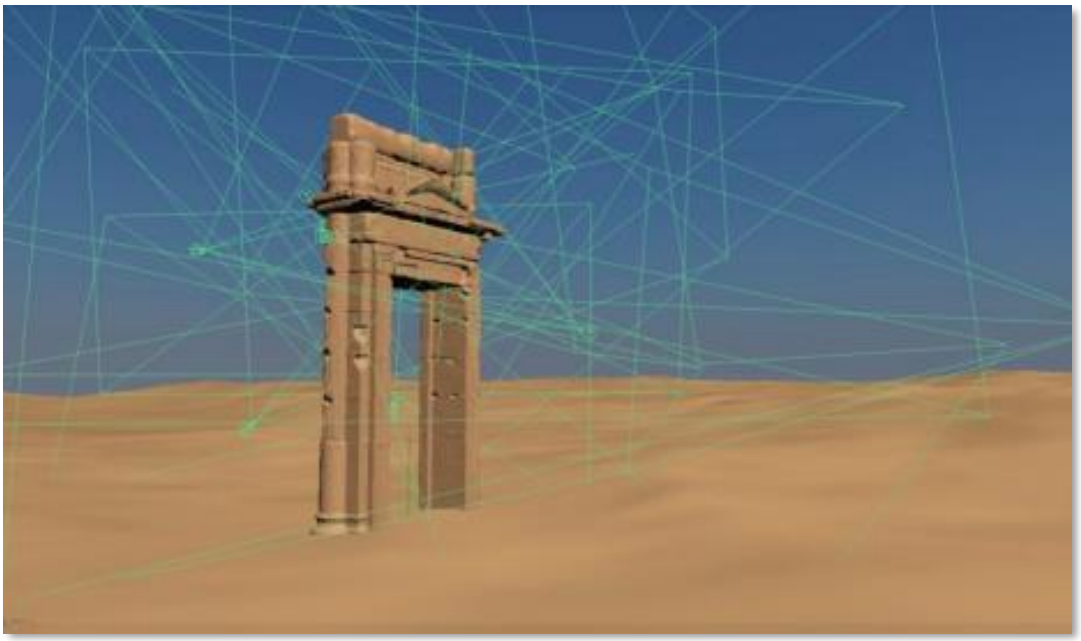

Figure 10. Three-dimensional rendering of the doorway of the Temple of Bel.
Source: (Intagliata, 2016).

Improved accessibility: Artificial intelligence can be used to create virtual reality experiences that allow people to explore and interact with heritage sites and artifacts in an immersive way. This is especially valuable for sites that are difficult to physically access or for fragile artifacts that cannot be handled directly. By incorporating artificial intelligence into heritage conservation efforts in Palmyra, we can use advanced technologies to protect its cultural heritage for future generations. Collaboration between conservation experts, technologists, and policymakers is essential to harness the full potential of AI in preserving Palmyra's rich history and architectural treasures.

This is where this paper brings to life the ancient site of Palmyra targeted by terrorist groups such as ISIS, using one of the artificial intelligence platforms "Artificial Intelligence Visualization". In this article, two examples of platforms for the visualization of human intelligence have been used: Midjourney and DALL-E 3. Artificial intelligence is used to generate images with robots like DALL-E 2 and Midjourney. DALL-E 2 is an artificial intelligence system that can create artistic images based on user-generated text inputs. This bot was created by OpenAI and released in April 2022. Midjourney is another AI bot that also generates images based on text inputs. Compared to DALL-E 2, Midjourney is more accessible, easier to use, and faster in producing images. However, DALL-E 2 offers more editing capabilities and product variety than Midjourney. Both bots use natural language and user descriptions to create images. DALL-E 2 is more versatile and can create images from anything, while Midjourney focuses on creating beautiful images. DALL-E 2 does not have a mobile app and can only be accessed through browsers. Meanwhile, Midjourney operates through a Discord server. Overall, DALL-E 2 and Midjourney are powerful AI tools for image generation. DALL-E 2 is better for creating a wider range of images, while Midjourney is better for creating beautiful images quickly and easily (Table 1).

Table 1.
Visualization and representation of heritage buildings of Palmyra using artificial intelligence capabilities DALL-E 3 and Midjourney.

Prompt	Dall-E3	Midjourny
Palmyra settlement building in Syria during the third millennium B.C		
Palmyra settlement building in Syria after ISIS attack		
Palmyra Settlement Building in the Future		

Source: (By author).

Methodology

The purpose of this study is to provide recommendations for sustainable strategies to preserve Palmyra's ancient heritage monuments despite the obstacles posed by the ongoing conflict in Syria. To achieve this, the study adopts a multidisciplinary approach that considers architectural, cultural, social, and political aspects. This study combines quantitative and qualitative data collection approaches in a hybrid approach. The first step in the research process will be an extensive evaluation of studies, articles, and other relevant sources on the topic of cultural heritage protection. The research then evaluates the success of ongoing efforts to conserve Palmyra using quantitative data analysis tools and makes suggestions for further conservation initiatives, including those involving AI capabilities. The combination of different study methods enables us to gain a thorough understanding of the cultural preservation environment of Syria, especially the obstacles and solutions for Palmyra. However, this study has certain limitations. First, gathering complete and current information may be more challenging due to limited access to specific locations and security concerns. This may affect data reliability and availability. Second, the ongoing Syrian crisis makes it difficult to fully document the extent of recent developments and ongoing heritage conservation activities. Despite the limited access to documents, the capabilities of artificial intelligence technologies such as DALL-E 3 and Midjourney in the visualization and mapping of cultural heritage sites have been utilized to create images and visual representations of Palmyra's heritage buildings and historical landscapes. Consequently, the conclusions may not include the most recent data. Furthermore, the subjective interpretation of data has its inherent limitations. The analysis may be unintentionally influenced by the perspective and biases of the researcher, which can compromise the objectivity of the study. In addition, the effectiveness and applicability of the proposed methods for cultural preservation may be affected by external variables and changing conditions in Syria, such as political, social, or economic changes. Therefore, it is necessary to pay attention to the changing conditions when implementing the study's proposals. Finally, the exclusive focus of this study on the historic buildings of Palmyra

may limit the applicability of the results to other heritage sites or the larger context of heritage conservation. As each heritage site is unique, its conservation strategies must be specially designed. Despite these limitations, this study is of great importance because it sheds light on complex problems and offers practical solutions to preserve Palmyra's distinctive cultural heritage. This adds to the body of knowledge about heritage conservation and provides valuable insights into the limitations and issues related to the study's conclusions. Future studies can fill these gaps and provide a more comprehensive picture of heritage conservation in Syria and elsewhere by recognizing these limitations.

Results and Discussion

The ongoing Syrian civil conflict has had devastating effects on the nation's cultural heritage. Important monuments have been looted, damaged, or destroyed, and the organization responsible for preserving Syria's cultural heritage, the DGAM, has faced criticism for its inaction. Reconstruction efforts for ancient Syrian sites have been hindered by the organization's refusal to collaborate with skilled specialists who fled the country during the crisis. Despite UNESCO's condemnations, cultural heritage destruction remains a significant challenge. Qualitative evaluations are essential to assess the extent of damage and evaluate the state of cultural resources in historic sites. These evaluations guide urban zoning, preservation plans, and reconstruction efforts, supporting regional economies and traditional crafts. Estimating damage has been challenging due to inaccessible combat zones. However, a collaborative project utilizing sophisticated satellite photography has produced significant findings. This project has identified unexpected trends in the location, severity, and timing of the damage, improving our understanding of the current cultural heritage crises in the Middle East. Local authorities, heritage communities, and international organizations must collaborate to preserve Syria's cultural heritage. The DGAM must work with skilled Syrian professionals to reconstruct and preserve ancient heritage. Addressing the legal implications and obligations related to the destruction of cultural property in the Syrian conflict is essential. Qualitative assessments must continue to play a central role in evaluating damage and guiding preservation plans. Remote sensing technologies and satellite photography have effectively monitored and protected archaeological monuments. Heritage conservation initiatives can benefit from enhanced data collection and analysis using these innovative strategies. Including cultural assets in urban development initiatives can support sustainable development by promoting economic growth, revitalizing traditional crafts, and generating employment opportunities. Despite the obstacles presented by the conflict, involving local people and utilizing cutting-edge technologies can help preserve and restore the priceless cultural heritage essential to Syria's identity, memory, and sustainable development.

Recommendations

Preserving the ancient heritage of Palmyra amidst the ongoing Syrian conflict requires a multi-faceted approach that goes beyond immediate restoration efforts. Long-term conservation strategies must take into account the broader implications for community recovery and sustainable development. This section presents several key recommendations aimed at preserving the cultural heritage of Palmyra and contributing to the overall well-being of affected communities. Integration with Community Recovery Efforts: Economic Revitalization: It is imperative to integrate conservation strategies with broader community recovery efforts to drive economic growth. Restoration projects have the potential to generate employment, boost tourism, and revive traditional crafts, thereby contributing to the sustainable development of affected communities.

Cultural Identity and Social Cohesion: The preservation of cultural heritage plays a pivotal role in fostering a sense of identity and continuity, which are fundamental to social cohesion and community resilience. Engaging local communities in conservation endeavors ensures that they remain connected to their heritage and reap the benefits of its preservation.

Continuous Collaboration and Knowledge Exchange: International Cooperation: Sustained conservation efforts necessitate ongoing collaboration among international organizations, local authorities, and heritage professionals. Knowledge exchange and capacity-building programs can bolster local expertise and facilitate the adoption of best practices in heritage conservation.

Cross-disciplinary Partnerships: Collaboration among archaeologists, architects, historians, and technologists is paramount. Leveraging AI and advanced technologies can aid in the documentation, assessment, and restoration of

heritage sites, offering innovative solutions to conservation challenges.

Legal and Institutional Frameworks: Strengthening Legal Protections: The establishment and enforcement of robust legal frameworks for heritage protection are critical. This encompasses the ratification of international conventions and the implementation of national laws that safeguard cultural heritage during conflicts.

Institutional Support: Strengthening the capacity of local institutions, such as the DGAM, through training and resource allocation, is essential. International support can provide technical assistance and funding for conservation projects.

Community Engagement and Education: Awareness Campaigns: Propagation of awareness regarding the importance of cultural heritage and its preservation through educational programs and public campaigns can cultivate a culture of protection and pride among local communities.

Involvement in Decision-making: Involving local communities in decision-making processes ensures that conservation endeavors are inclusive and reflect the needs and values of the individuals most affected by the conflict.

Technological Integration: Utilizing AI and Remote Sensing: AI technologies and remote sensing can deliver accurate damage assessments, predict future threats, and generate virtual reconstructions of destroyed heritage buildings. These tools can bolster the effectiveness of conservation strategies and facilitate continual monitoring and protection of heritage sites.

Digital Documentation: Creating digital archives of cultural heritage using AI and other technologies ensures the preservation of records, even if physical sites suffer further damage or destruction.

Conclusions

The study on heritage conservation in Syria focuses on the challenges and strategies for conserving the ancient Palmyra heritage building, providing crucial insights into preserving cultural heritage in conflict-affected regions. The deliberate targeting of the Palmyra heritage building by terrorist groups like ISIS underscores the urgent need for effective conservation strategies. The destruction and damage inflicted on this iconic site emphasize the importance of safeguarding and protecting valuable historical treasures.

Moreover, the study identifies a range of challenges faced in heritage conservation in Syria, including armed conflict, political instability, limited resources, inadequate funding, and restricted access to affected areas. To address these challenges and ensure successful conservation efforts, it is imperative to involve multiple stakeholders, including local communities, government organizations, non-profit entities, and international bodies.

Based on the findings, several recommendations emerge to enhance the conservation of the ancient Palmyra heritage building and other heritage sites in Syria:

1. Strengthening international cooperation: Intensify collaborative efforts among UNESCO, international organizations, and donor countries. This collaboration should involve providing financial support, technical expertise, and capacity building for heritage conservation projects in Syria. Sharing best practices and experiences from similar initiatives in other conflict-affected regions can also be beneficial.
2. Empowering local communities: Active involvement and empowerment of local communities are crucial for the long-term sustainability of heritage conservation efforts. Engaging them through community-based initiatives, training programs, and awareness campaigns can instill a sense of responsibility and pride in protecting and preserving their cultural heritage.
3. Implementing comprehensive risk management plans: Developing and implementing robust risk management plans is vital to minimizing further damage to heritage sites. These plans should address the impact of armed conflict, natural disasters, climate change, and unauthorized human activities. Regular monitoring, documentation, and emergency response strategies should be integral components of these plans.
4. Promoting sustainable tourism: Sustainable tourism can contribute to revenue generation for heritage conservation projects and local economic development. However, it is crucial to ensure that tourism activities are carried out responsibly, respecting the integrity of the site and benefiting local communities. Implementing regulations, guidelines, and controls for visitor numbers

and infrastructure development can help achieve this.

5. Leveraging AI technologies: Integrate artificial intelligence (AI) tools into heritage conservation efforts to enhance data collection, analysis, and visualization. AI can assist in documenting and mapping archaeological sites, assessing damage, predicting threats, and creating immersive experiences for public engagement. Collaborating with AI experts and leveraging innovative AI platforms can revolutionize heritage conservation strategies in Syria and beyond.

By implementing these recommendations, we can ensure the preservation of Syria's rich cultural heritage for future generations despite the challenging circumstances posed by conflict and instability.

Bibliographic references

Albayati, R., & Alobaydi, D. (2023). Conservation of Urban Heritage Landscapes: Lessons from Souq AlSaffarin in Baghdad, Iraq. *ISVS-e Journal*, *10*(8). Available at: https://doi.org/10.61275/ISVSej-2023-10-08-04

Al-Maqdissi, M. (2020). Archeology of the Middle East, the shipwreck of ethics. Archeology in the Middle East, foundation of ethics. *Ponent Archeology Magazine*, *30*, 195-201. Available at: https://repositori.udl.cat/items/0e555c6a-a0bc-4dd5-b313-41989c435cca

Arkawi, A. (2017). Vision of the reconstruction of destructed monuments of Palmyra (3d) as a step to rehabilitate and preserve the wholesite. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *42*, 41-48. Available at: https://doi.org/10.5194/isprs-archives-XLII-2-W5-41-2017

Casana, J., & Laugier, E. J. (2017). Satellite imagery-based monitoring of archaeological site damage in the Syrian civil war. *PloS one*, *12*(11), e0188589. Available at: https://doi.org/10.1371/journal.pone.0188589

Ćwik, A. (2020). The need for local communities' involvement in the future of real cultural heritage. *Culture-Society-Education*, *18*(2), 367-381. Available at: https://doi.org/10.14746/kse.2020.18.13.2

Denker, A. (2022). Palmyra in Context: An Intelligent Reality Application to Revive the Victimized Bride of the Desert. I*n 2022 IEEE 2nd International Conference on Intelligent Reality (ICIR)*, 35-38. IEEE. Available at: https://ieeexplore.ieee.org/abstract/document/10070895

Fincham, D. (2015). The syrian conflict and the proposed "protect and Preserve International Cultural Property Act". *Santander Art and Culture Law Review*, *1*(2), 63-82. Available at SSRN: https://ssrn.com/abstract=2742303

Harmanşah, Ö. (2015). ISIS, Heritage, and the Spectacles of Destruction in the Global Media. *Near Eastern Archaeology*, *78*(3), 170-177. Available at: https://doi.org/10.5615/neareastarch.78.3.0170

Ibrahim, S. (2020). Decision-Making Methodology Between Revitalisation and Rehabilitation of World Heritage City Centers. Case Study: The Ancient City of Aleppo (syria). *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, *44*, 255-262. Available at: https://doi.org/10.5194/isprs-archives-XLIV-M-1-2020-255-2020

Intagliata, E. (2016). *Palmyra: An Assessment of Virtual and. Physical Reconstruction Techniques and their Ethical Implications. Ancient History and Classical Archaeology* (MA (Hons) Thesis), The University of Edinburgh. Available at: https://acortar.link/4HchKx

Jana, H., & Jana, S. (2017). Palmyra palm: Importance in Indian agriculture. *National Agriculture*, *12*(2), 35-40. Available at: http://researchjournal.co.in/online/RKE/RKE%2012(2)/12_35-40.pdf

Mansurov, T., & Krylov, A. (2018). Information aspects of «hybrid war» in the syrian conflict and their influence on positions of participants of confrontation. *Amazonia Investiga*, *7*(14), 375-380. Retrieved from https://www.amazoniainvestiga.info/index.php/amazonia/article/view/532

Pages Madrigal, J. M. (2021). Heritage Preservation as Strategy for Recomposing Conflict Territories. *Journal of Contemporary Urban Affairs*, *5*(2), 252-264. Available at: https://doi.org/10.25034/ijcua.2021.v5n2-8

Rasoolimanesh, S. M., & Jaafar, M. (2016). *Community participation toward tourism development and conservation program in rural world heritage sites*. In Tourism-from empirical research towards practical application. IntechOpen. Available at: http://doi.org/10.5772/62293

Ryzheva, N., Nefodov, D., Romanyuk, S., Marynchenko, H., & Kudla, M. (2024). Artificial Intelligence in higher education: opportunities and challenges. *Amazonia*

Investiga, *13*(73), 284-296. https://doi.org/10.34069/AI/2024.73.01.24

Shcherbina, E.V., Belal, A.A., & Salmo, A. (2020). Historic centres of Syrian towns ruined by the war: Restoration through urban planning. Vestnik MGSU, *Monthly Journal on Construction and Architecture*, *15*(5), 632-640. Available at: https://acortar.link/Y1maoW