Towards Rural Landscape Planning

the Importance of Heritage Preservation in Oases in Mediterranean Countries – Case Studies: Siwa Oasis (Egypt), Ghardania Oasis (Algeria), Gafsa Oasis (Tunisia) & Figuig Oasis (Morocco)

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Abstract

As for this paper, it intends to evaluate the status of conservation of Mediterranean oases such as Siwa of Egypt, Ghardaia of Algeria, Gafsa of Tunisia, and evaluate Figuig of Morocco. The purpose is to outline the measures and recommendations that can be included in practice in order to reconsider heritage protection in Figuig with references to other oases. Hence, in this study, it analyses the main problems and solutions concerning heritage management based on the analysis of the literature and comparison of different cases. Thus, the results highlight the importance of sustaining the involvement of the local communities, the proper farming techniques, the promotion of eco-tourism, and the effective use of modern technologies for the preservation of the cultural and geographical identity of the oasis. Therefore, the aim of this research is to establish the measures on which the sustainability and preservation of the Figuig oasis could be addressed and handed down to the next generations.

Keywords: *Heritage Preservation, Mediterranean Oases, Siwa Oasis, Ghardaia Oasis, Gafsa Oasis, Figuig Oasis, Sustainable Agriculture, Cultural Heritage, Water Management, Conservation Strategies*

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Introduction

An oasis is a fertile tract of land that occurs in a desert wherever a perennial supply of fresh water is available. Oases vary in size, ranging from about 1 hectare (2.5 acres) around small springs to vast areas of naturally watered or irrigated land (Hadagha et al. 2018).

Oases are also unique cultural, historical and ecological landscapes and therefore the preservation of the heritage in oases is considered to be of great importance. Indeed, the human histories of some of the harshest desert margins, those featuring desert oasis, now appear as major foci of early human development - as centers of people, centers of culture and even centers of trade over thousands of years. Oases represent distinctive cultural, historical, and ecological environments, making the protection of their heritage a significant priority. As unique repositories of cultural, historical, and ecological values, oases require careful preservation of their heritage. The rich cultural, historical, and ecological characteristics of oases highlight the importance of safeguarding their heritage. Oases are exceptional landscapes where cultural, historical, and ecological elements coexist, emphasizing the need for heritage conservation. Because oases embody unique cultural, historical, and ecological assets, preserving their heritage is of paramount importance. The heritage found in oases deserves special protection due to its distinctive cultural, historical, and ecological significance. Oases serve as valuable cultural, historical, and ecological landscapes, underscoring the necessity of preserving their heritage for future generations. Recognized for their unique cultural, historical, and ecological features, oases require sustained efforts to conserve their heritage. Conservation of oasis heritage is crucial, as these landscapes possess exceptional cultural, historical, and ecological value. Oases constitute irreplaceable cultural, historical, and ecological landscapes, making heritage preservation an essential responsibility (Bretzke et al. 2025).

Oases in the Mediterranean Basin have contributed towards shaping the socio-economic and cultural landscape of all societies. It is both important to preserve them and necessary to sustain and nourish that ancient landscape that still provokes wonder, awe and humility (Lassoued and Rejeb, 2016).

It is known that Siwa Oasis in Egypt where cycles of history stretch back to Alexander the Great and the culture therein is unique Berber culture. The Ghardaia Oasis in Algeria is known for its distinctive M'zab architecture, and its unspoiled, centuries-old, traditional style of communal living, using its closely-spaced buildings to actively cool itself and thereby lower temperatures to a bearable degree within its walls. The Gafsa Oasis in Tunisia is one example. Its ancient irrigation systems and sustainable agricultural practices have allowed local communities to survive for centuries. But in the modern era, they are to some extent a dying oasis. Their sustainability and cultural integrity are being tested by rapid urbanization, climate change, water scarcity, economic pressures and large-scale Hindu tourism in India. Thereby, these solutions would have to be supportive in a variety of ways such as sustainable agriculture; community participation; ecological tourism; in addition to policies taking part in the identification by the state and international agenda (Santaro, 2023).

The Figuig Oasis in Morocco acts as a telling case study to explore this reality of the past and look into the future from this lens-at once concerned with the current state of heritage preservation and with the hope of change along the way. Figuig is an eastern town in Morocco and is a historic town with a deep culture. As with most examples of built heri-

tage from the Saharan Inscriptions, Figuig faces a range of challenges including poor water management, the disappearance of traditional knowledge and livelihoods, and lack of income- generating opportunities (Salgot et al. 2014).

In this article, we investigate conservation efforts in different Mediterranean oases (Siwa, Ghardaia and Gafsa), and contrast strategies implemented in Figuig Oasis

Aims of the Study

During this study, the main objective is to assess the conservation efforts in the Mediterranean oasis, compare these efforts to those in the Moroccan Figuig oasis, and propose strategies to promote Figuig's preservation, using successful examples from other areas of the world.. This study comes at a time of increasing interest in preserving the cultural and natural heritage of the oases, as these oases represent a rich store of history, culture and environmental diversity.

The study includes a comprehensive analysis of the efforts made in Mediterranean oasis such as the Siwa Oasis in Egypt, the Ghardaia Oasis in Algeria, and the Gafsa Oasis in Tunisia, and identifies the common factors and challenges facing these efforts. By comparing these efforts with the current situation in Figuig Oasis, the study seeks to understand the gaps and challenges specific to Figuig Oasis and provide recommendations based on best practices from other oasis (Figure 1). These recommendations include enhancing local community participation in heritage conservation efforts, adopting sustainable agricultural practices, developing ecotourism initiatives that boost the local economy and support heritage conservation, obtaining funding and support from international organizations, and using modern technology to improve water resources management, agricultural practices and conservation.

Oasis Name	Country	Specific Location	Landscape Characteristics
Siwa Oasis	Egypt	Western Desert, near the Libyan border, about 300 km southwest of the Mediterranean coast	Characterized by salt lakes, natural springs, extensive date palm and olive groves, sand dunes, and the surrounding Great Sand Sea. The landscape combines fertile agricultural land with arid desert scenery.
Ghardaia Oasis	Algeria	M'zab Valley, northern Sahara Desert, central Algeria	Features a desert valley landscape with palm groves, traditional ksour (fortified settlements), rocky terrain, and a hot arid climate. The oasis is integrated with a distinctive urban and agricultural landscape.
Gafsa Oasis	Tunisia	Gafsa Governorate, southwestern Tunisia	Composed of a multi-layered agricultural landscape with date palms, fruit trees, vegetables, and cereals. The oasis is surrounded by semi-arid and desert environments and benefits from traditional irrigation systems.
Figuig Oasis	Morocco	Oriental Region, eastern Morocco, near the Algerian border	Consists of palm groves, terraced gardens, traditional ksour, and a network of springs and khettara irrigation systems. The oasis lies between the High Atlas and Saharan Atlas regions within a pre-Saharan desert landscape.

Figure 1. Characteristics of the four oases.

Historic sites, and develop comprehensive heritage preservation plans that include clear goals, timelines, and specific responsibilities to ensure the effectiveness of heritage preservation efforts. Through these strategies, Figuig Oasis can maintain its cultural and ecological balance and achieve sustainability for future generations.

Methodology

A literature review was conducted to examine the relationship between urban growth and the environment, focusing in particular on oasis habitats in the Mediterranean region. Additionally, all relevant governmental documents, reports and web links were also reviewed. This study reviews existing scientific literature on conservation of heritage in oasis, focusing on key aspects such as historical importance, conservation of architecture, sustainable practices and community participation.

The methodology includes a literature review and a comparative analysis. The study begins with a comprehensive literature review, analyzing scientific articles, academic journals, government reports and NGO publications that provide an in-depth look at heritage conservation efforts in oases such as Siwa, Ghardaia and Gafsa. The former method would serve to understand the historical and cultural context of each oasis, to observe applied conservation strategies and plans, and to reflect on the facing challenges. This strategy gives us qualitative data that we can directly return to in order to better understand the local context and pinpoint areas for work that are as of yet insufficient. These collected data are going to be the basis for the comparative analysis implemented to determine successful strategies in heritage preservation in there oases of Siwa, Ghardaia and Gafsa, and to examine them relative to the situation in Figuig Oasis. This analysis allows the strengths and weaknesses of each of these efforts to be identified, enabling specific recommendations to strengthen heritage conservation efforts in the Figuig Oasis.

Results

Long-term land-cover and habitat monitoring is necessary to assess changes in landscape ecological features in order to: (a) comprehend the drivers of the temporal changes; (b) plan for future trends; and (c) develop appropriate conservation policies (Fisher and Lindenmayer 2007; Bunce et al. 2008; Nagendra et al.2004).

On the other hand, Oases are recognised to offer a variety of ecological services, including socioeconomic advantages, resilience to soil erosion and degradation, decreased danger of flooding, and delaying the effects of climate change (Dahri and Abida 2020; Haj-Amor et al.2020). These oases are not only important for local populations but also for several avian species (Hamza et al.2022). Due to their mild microclimatic conditions, many Palearctic birds winter in these kinds of agroecosystems (Hamza and Hanane 2021).
As a result of our literature review and local government resources research, the findings we obtained regarding the oasis in this article were described as follows:

Siwa Oasis -Egypt

Siwa Oasis -Egypt lies on the edge of the Great Sand Sea only 300km southwest of the Mediterranean and Marsa Matrouh (L. Rovero and others, 2009), and around 70km east of the Libyan border. Siwa is famous for its dates, along with olives and oranges. Siwa averages 18m below sea level and has always had more than its share of excess ground water, and the salinity of the ground and the size of the lakes have increased over centuries of agriculture and irrigation run-off. Siwa has been inhabited from earliest times, Figure 2. There are tombs and other remains dating from the Late Dynastic period in Siwa. A large number of monuments from the Greco-Roman era (Hatem T, 2008), which began with the

reign of Alexander who was recorded visiting the place, indicate a population boom in the oasis at that time. Today most of the population lives in the town of Siwa, a few other villages are scattered in other parts of the depression. The oasis enjoys a unique environment that combines lush cultivated areas, natural vegetation, and stark desert landscapes. There are several salt lakes in Siwa, and Siwa is also rich in its flowing springs of sweet sparkling water (Asham et al. 2023; Hassan 1978).

Figure 2. A traditional settlement in the west desert in Siwa, Egypt.

The need to preserve vernacular architecture has grown in recent years. Human demands have evolved as a result of development, since people now choose to employ new technology that can improve their lives in every way. Modern construction techniques and architectural technology have a significant impact on architectural design, particularly in isolated desert vernacular towns where cultural legacy must be conserved. When exploring Siwa, we discovered:

- Urban morphology

Siwa continues to preserve a compact, narrow, and erratic layout that limits vehicle traffic while promoting a comfortable pedestrian environment (Mohamed A. Hanafi and Ahmed Y. Rashed, 2004, Figure 3).

Figure 3. Urban morphology and texture in Siwa, Egypt.

- Landscape

Siwa Oasis is characterized by beautiful natural landscapes, including:
Scenic salt lakes, Great Sand Sea and agricultural landscape with date and olive trees (Mervat ElShafie, 2010) (Figure 4).

Figure 4. Landscape in Siwa, Egypt.

- Built Up Heritage

Alexander the Great's temple and tombs from the early pharaonic periods provide historical evidence for a very early beginning. In Siwa, there is a significant abundance of traditional dwellings (Eltawil H, 1989, Figure 5).

Figure 5. Alexander the Great's temple.

- Vernacular Architecture

The built environment can be divided into three categories: new concrete structures imported from the valley, old traditional houses that are mostly falling apart, and neotraditional attempts that replicate traditional elements sometimes using entirely different materials, like steel (Marwa Dabaieh, 2011, Figure 6).

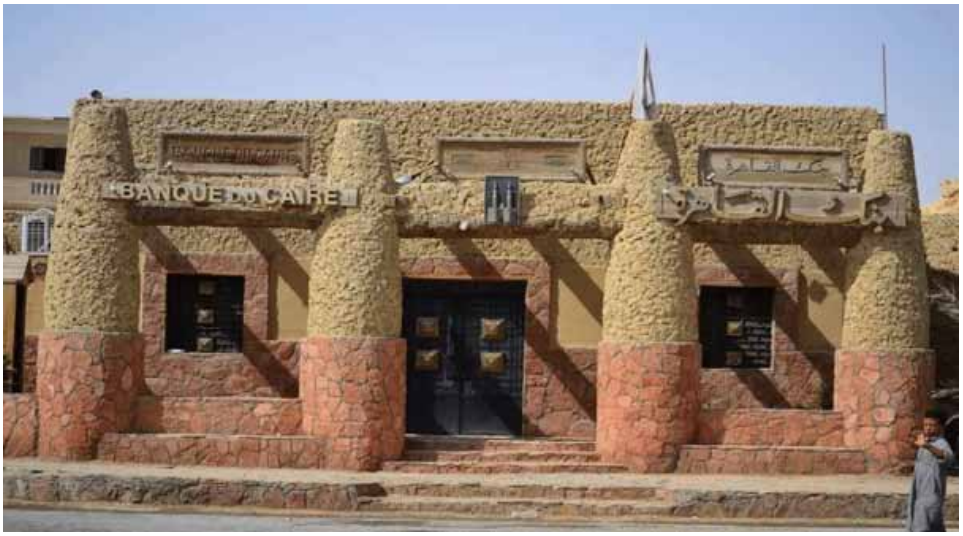

Figure 6. The local bank in Siwa, Egypt.

Preservation Plans in Siwa, Egypt

It is clear that Siwa Oasis is rich with vital cultural heritage landscape that is why it requires preservation which reflects an image of urban desert communities and oases ecosystem including the remnants of features witness to its style. Therefore, it should preserve the site with stock rare and valuable physical characteristics, and to raise residents through a comprehensive system for aspects of physical, economic, social and others. There are some preservation plans in Siwa oasis in different fields:

Initiatives for Culture Conservation: These range from documentation of the rich and diverse tradition of Siwan music, dance and handicrafts. These old traditions are kept up because NGOs (both local and international) have worked tirelessly to promote cultural festivals and workshops.

Architectural Conservation: Restoration projects to protect ancient Tali Fortress built of kershef (a mixture of salt and mud) and other historical sites. These projects tend to be partnerships between the Egyptian state, UNESCO and heritage organizations. Development of Sustainable Tourism: In order to minimize the impact of tourism on local environments and cultures, eco-friendly tourism development initiatives have been undertaken. Such measures include eco-lodges and guided tours reinforcing an ethos of sensitivity towards the shared natural and cultural heritage of Siwa.

Ghardaia Oasis, Algeria

General informations about Ghardaia Oasis, Algeria

Ghardaia is located in the south of Algeria, which is well known by its hot arid climate, its ksurs (dense old buildings), its river, and its detached houses surrounded by Palme trees. The climate of Ghardaia is characterized by a very hot dry summer, the mean summer temperature in July is 36.8°C and the maximum absolute temperature is 46°C.

Historical and Cultural Significance

It was founded by the Mozabites, an Ibadi sect of the Berber Muslims. It is a major center of date production and the manufacture of rugs and cloths. Divided into three walled sectors, it is a fortified town. At the center is the historical M'zabite area, with a pyramid-style mosque and an arcaded square.

The oasis is known for its rich cultural heritage, including unique traditions, customs, and a communal way of life centered around the Ibadi religious community.

- Architecture and Urban Planning

One of Ghardaia's most distinctive aspects is its architecture (M'zab Architecture). Traditional building techniques are used to construct the structures, which are made of locally obtained materials including stone, mud, and palm trunks. In Ghardaia, there are a variety of natural building materials such as (sandstone and black stone suitable for construction, and on the one hand, IJESC, white stone suitable for paving, and limestone suitable for ceilings and arches hidden in it, and it is used to whiten walls, when necessary, gypsum and lime are used as cement) (figure 7).

Figure 7. The architecture in Ghardaia oasis in Algeria.

Preservation Plans in Ghardaia, Algeria

Several methods have been adopted to preserve the cultural and architectural heritage of the Ghardaia Oasis in Algeria. The Heritage and Urban Planning Law is 90-29 dated December 1, 1990. Certainly, its innovation is the Land Use Plan (P.O.S.) and the Master Plan (P.D.A.U.) that replaced the (P.U.D.). This law aims to issue general rules to regulate urban real estate production, prepare and transform the urban environment, and balance between preserving the environment and historical centers with cultural heritage, in accordance with the national policy for urban and urban planning (P.O.S.) sets out in detail land use and building rights. It refers to neighborhoods, streets, monuments, and sites that need to be preserved, renovated, and restored.

In addition, the effort to integrate housing on sloping land gave rise to a variety of architecture. Designed for egalitarian community living, the architecture of housing in the oasis gives more respect to the family privacy. Each house has an underground room and two upper levels, with a space in the center, transparent with a sky window. For the period of summer, Mozabits move around to their homes located in the palm grove oases, watered by devised irrigation elements or sharing water systems (Riphenburg, 2006). Traditional Mozabit houses offer climatic arrangement suited to their climate. It is important to keep the example. There is a possibility to adapt them according to the “modern comfort” and construct' modern buildings' that are inspired from the traditional houses (Ravereau, 2007).

The Ghardaia oasis has been classified as protected area. The protected zone concerns the entire valley with a total area of 54 km2. Following this classification, a permanent plan of safeguard and development of the safeguarded sector (P.P.S.M.V.S.S) has been launched. The Office of Protection and Promotion of the oasis (OPVM) committed an ambitious program of restoration concerning historic monuments; such as religious and defensive buildings as well as water infrastructures.

Gafsa Oasis, Tunisia

General information about Gafsa Oasis, Tunisia

The historical oasis of Gafsa is one of the best expressions of the agriculture adaptation to arid climate in Tunisia. Covering more than 700 hectares, it has permitted to afford to the needs of the local communities. Based on the complex multi layered systems, this oasis is today threatened by the evolution of the production objectives: exportation and monoculture (figure 8).

Figure 8. Gafsa Oases, Tunisia.

Based on the multilayered systems, the historical oasis is a land of cereals, vegetables, fruits and date palms production. These intensive production lands represent 10% of the regional production or 9 million of Tunisian dinars. In addition, it is about 2500 and 5000 persons who are working permanently and seasonally in this oasis, insuring an income for the local communities.

Thanks to the different layers, many varieties can be cultivated in this oasis. The species and varietal biodiversity are high with some threatened local endemic varieties of trees notably of apricot trees. There are 98 varieties of date palms, 10 fruit trees species and 15 species of vegetables (the Food and Agriculture Organization (FAO) report on the Gafsa Oasis in Tunisia).

Besides, the oasis is a habitat for spontaneous wild plants, animals, fishes or amphibians from the region. It is also considered a settlement for some migratory species such as Hoopoe birds. Due to the vegetation it allows reducing erosion risks in this windy region (Kadri and Van Ranst 2002; Kouki and Bouchaouach, 2008).

Oasis agriculture is part of the local communities' culture: traditional wool-making methods, traditional olive oil extraction, are just some examples of a rich traditional knowledge. Gafsa weaves are famous among Tunisia for their beauty and quality. Moreover, Gafsa culture has a traditional cuisine specialty linked to the product grown in the oasis. Furthermore, traditional knowledge and cultural functions have helped to preserve the traditional water management.

Preservation Plans in Gafsa Oasis, Tunisia

The current situation that the oasis sector is experiencing calls for support for multi-layered agricultural systems, such as the Gafsa Oasis, which relies on this system, as studies have proven its resilience and ability to withstand climate change, unlike modern oases that rely only on the Deglet Nour palm tree.

Smart irrigation practices must also be adopted to provide the palm trees and various crops grown in the oasis with the amount of water they need at each stage of their life cycle.

During the Regional Forum for Environmental Justice in Gafsa 2021, the Tunisian Forum for Economic and Social Rights stressed the importance of enforcing laws and legislation related to the oasis sector, especially the abandonment law. He also called for tightening control over unplanned construction on agricultural lands and taking measures to combat urban sprawl at the expense of oasis areas.

In addition, the cultivation of date varieties that consume less water will be encouraged, while preserving the soil, which is an essential element of the oasis, and ending all practices that lead to its degradation, such as industrial pollution and toxic gases emitted by institutions specialized in the field of extraction. Industries such as the Gafsa Phosphate Company and the Chemical Group (the Regional Forum for Environmental Justice in Gafsa 2021).

It is also recommended to adopt the ancient oasis model that is capable of adapting to climate change. Environmental defenders also called for activating the provisions of the National Charter for the Protection and Development of Oases in Tunisia. This national declaration aims to recognize the oasis system and take into account all its environmental, social, economic and cultural dimensions.

In the face of these challenges, Tunisia must adopt and implement a vision for sustainable development in order to preserve the wealth of the oases and search for real alternatives to support farmers in facing the challenges posed by agricultural activity in the oases and adapting to climate change, as recommended by the Tunisian Forum for the Advancement of Development (Noureddine Nasr, an agricultural engineer and researcher specializing in rural geography)(the agricultural crisis in Gafsa 2021).

Figuig Oasis, Morocco

General information about Figuig Oasis, Morocco

Figuig is an oasis located in the far east of Morocco in the Oriental region. It is located in the immediate vicinity of the Algerian border, approximately 400km south of the Mediterranean. Due to its location on the borders of the Eastern High Atlas and the Saharan Atlas, Figuig is part of the pre-Saharan continental oases (Figure 9). Currently, the oasis is made up of an urban core of seven ksour (Figure 10).

Ksour: plural of ksar, fortified village, the term designates… built in earth (Laâbidate, Elmaïz, Hammam Foukani, Hammam Thatanie, Loudaghir, Ouled Slimane and Zenaga) (Figure 10) and more recent districts (in the center the administrative district, in the north and east of new residential areas). In 2008, the city had 12,613 inhabitants.

The oasis is located on two levels, separated by the jorf (travertine escarpment similar to a cliff, approximately 30m high). The upper part, the plateau, brings together six ksour; the lower part, the plain, is occupied by Ksar Zenaga and the majority of palm plantations.

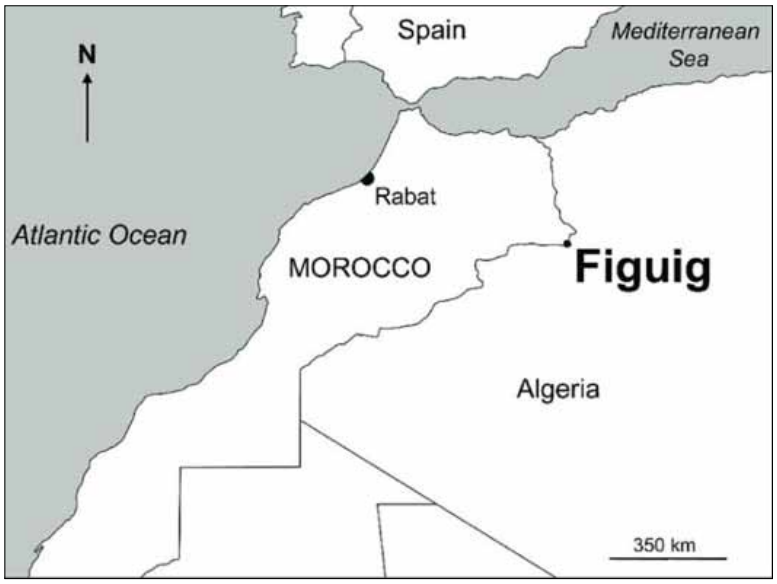

Figure 9. The location of Figuig oasis, Morocco.

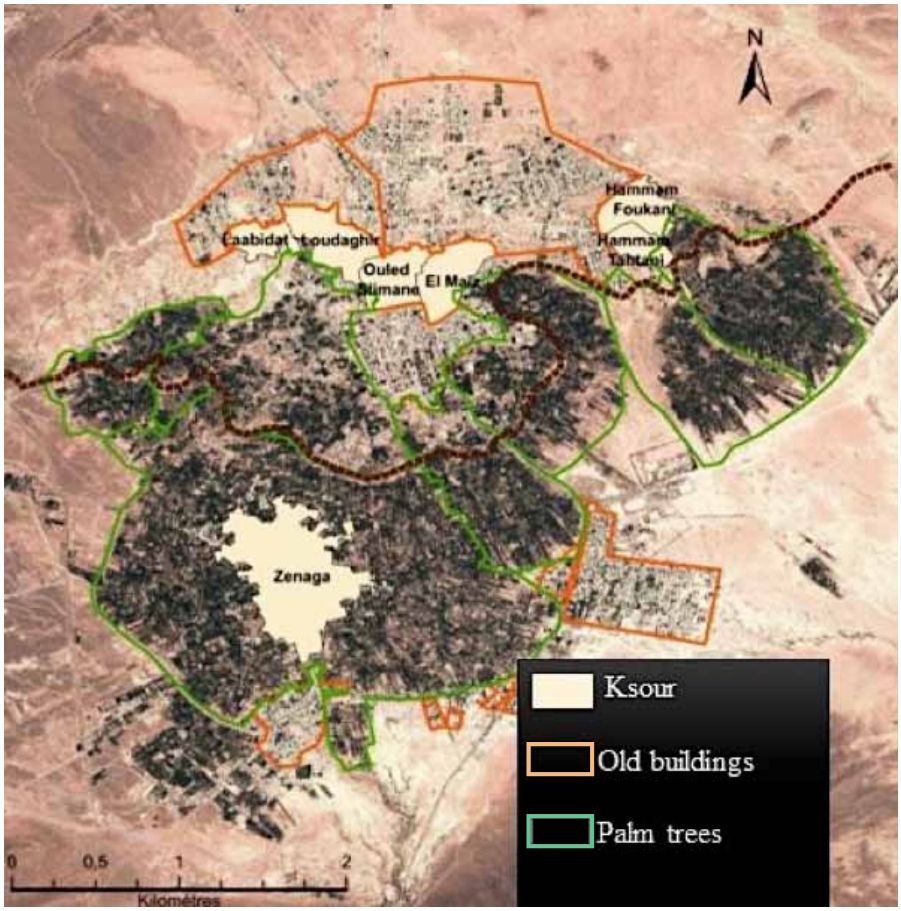

Figure 10. Organization of human settlements in the Figuig oasis(from Gillot and Vallat 2019).

Among the features of this oasis, we find:

- Historical and Architectural Significance

Figuig Oasis has been continuously inhabited since at least the 10th century. Its strategic location on the trans-Saharan trade routes facilitated the exchange of goods such as dates, salt, and gold, contributing to its prosperity and cultural richness. The ancient kasbahs (fortified villages) and mud-brick houses reflect the oasis's long-standing architectural heritage (figure 11).

In view of the importance of the architectural heritage of the Figuig Oasis, which is steeped in history and has unique engineering value, the site and palaces of the oasis were listed among the monuments, and they were also included on the UNESCO Certification List in May 2011.

In a similar statement, researcher Professor Mustafa Lali explains that the palace in the Figuig Oasis is considered an urban unit that includes several adjacent houses built according to a precise architectural and engineering design that responds to the requirements of living in the region.

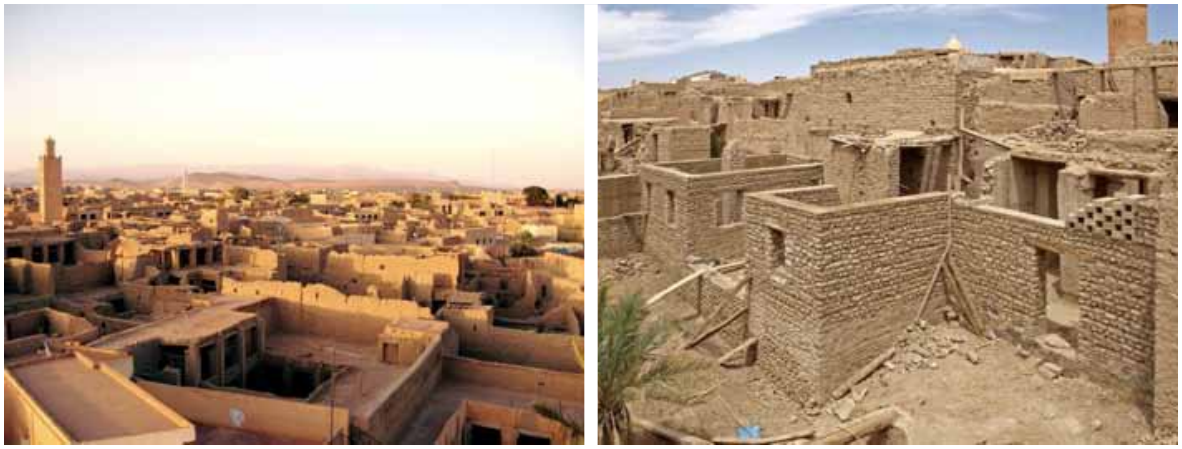

Figure 11. The ancient castles and mud-brick houses in Figuig oasis, Morocco.

- Agricultural Practices and Irrigation System

Agricultural activities predominate in Figuig Oasis, occupying an estimated 650 hectares. In order to make optimal use of the field, agriculture is practiced in a layered form of three levels, where palm trees are at the highest level and represent 80% of the number of fruit trees planted, and their number is estimated at about 120 thousand palm trees, of which 110 thousand palm trees produce various types of dates. The finest dates are “Aziza” dates. As for other fruit trees, they come in the middle level, while land crops occupy the lowest level. The intensive agriculture practiced in the oasis is linked to livestock raising, but the returns of this agriculture generally tend toward decline, especially with the increase in population migration towards major cities or abroad, which explains the deterioration and decrease in the size of exploited lands (FAO; Food and Agriculture Organization of the United Nations).

The survival and continuity of the Figuig oasis is linked to the presence of groundwater. The fresh water provided by the thirty (30) springs that currently feed the population of Figuig and its palm oasis with a flow of about 175 liters per second (in the year 2000), noting that the majority of these springs are located on the plateau, while the agricultural lands extend in the southern plain where the Zanaka Palace is located, which includes about 40% of the oasis's population, and exploits nearly half of the general flow of existing spring water.

Figuig is renowned for its sophisticated irrigation system known as "khettara" (Figure 12). This ancient technology channels underground water through a network of tunnels to irrigate crops, enabling sustainable agriculture in the harsh desert environment. The oasis is particularly famous for its high-quality date palms (Figure 13), which produce a variety of dates that are a staple of the local economy (GIAHS; Globally Important Agricultural Heritage Systems).

Figure 12. Khettara irrigation system in Figuig oasis, Morocco.

Figure 13. Date palms in Figuig oasis, Morocco.

Preservation plans in Figuig oasis, Morocco

Figuig is a pre-saharian oasis which has been undergoing for several years the negative effects of its frontier position. The political instability and the socio-economic problems bound to the closure of the frontiers between Morocco and Algeria have limited the possibility of commercial and touristic activities, while favoring the flux of clandestine goods that strongly compete with both local products and legally imported ones.

Although the region has a high potential due to natural resources, richness of landscape sand biodiversity; although the strategic position could favor relations of vicinity with both Mediterranean and Saharan territories, Figuig has been unable in recent times to play any relevant role in the national economy.

The city is characterized by a specific spatial arrangement made of an interwoven constellation of seven separate Ksurs (neighborhoods), each linked to one or several palm-groves. This spatial and cultural structure is now disappearing due to the abandonment of the historical centers and to the construction of new dispersed settlements around them. Most important, the ungoverned expansion of settlements is causing a great amount of urban management problems, mainly consisting in the lack of infrastructural links and in the uneven distribution of public services and welfare provisions.

Given such a problematic background, Africa'70 elaborated a rehabilitation project on the historical heritage of the oasis in conjunction with several local associations, pursuing the amelioration of the living conditions of Figuig's inhabitants through a number of initiatives addressing the poor conditions of its built environment.

The role of ASF-Italia: the final objective of ASF's work is to trace a methodological path on how to elaborate the strategic plans that are necessary for a sustainable governance of Figuig's territory. The first on-field investigation was conducted in October 2005, aimed to shed light on the recent evolution of Figuig's urban fabric. Relief maps were drawn on each Ksur, highlighting the numerous factors that contribute to their specificity and the most evident problems in the state of conservation of the buildings and the urban fabrics, together with problems generated by the casual introduction of inappropriate building techniques (Architettura Senza Frontiere Italian Network,2003).

Although there were several proposals and plans to preserve the Figuig Oasis, they were not implemented, which caused economic deterioration in the oasis as well as in architectural, cultural and agricultural terms.

Discussion and Recommendations

Based on the above discovery, it is indicated that the strategies for the preservation of heritage in Siwa Oasis is marked by documentation and marketing of Siwan traditions, the rehabilitation of the historical structure Shali mud castles and promoting environmentally sustainable eco-tourism. In Ghardaia Oasis steps are being taken to conserve bio-diversity, Mozabite culture and architecture in addition to the restoration the traditional water systems. Regarding the axes of modernization of Gafsa Oasis; the use of modern irrigation methods in combination with the traditional ones; encouragement of organic farming and the promotion of heritage tourism as the main axes.

The cases of Siwa and Ghardaia reveal that specific approaches based on the locals' engagement to achieve sustainable protection of cultural heritage sites are effective. It also suggested that for Figuig Oasis it would be beneficial to use methods similar to that of educational programs and workshops focusing on the need to preserve the heritage and on how local communities can be used to promote and support the said cause. Second, is its ability to adopt a dual approach in the application of new technological methods of farming as well as the traditional practices in the farming of Gafsa. Similarly, Figuig Oasis must adapt these measures to enhance productivity of its agricultural sector through a suc-

cessful combination of the modern and sustainable farming practices that include use of efficient irrigation techniques without forgetting the traditional ways of farming.
The Figuig oasis presents itself as a coherent, material and cultural whole, where there is complementarity between the architecture and spatial organization of the area, the palm grove and its irrigation system and all social and cultural practices. This configuration is accentuated by its landlocked situation, generated by the closure of the Algerian border.

The elements to be protected are therefore as follows:

- Occasional monumental buildings: remarkable buildings such as mosques, cemeteries, the synagogue, the Saint Anne church, marabouts and squares.
- The architecture of the ksour and its urban organization: Ephemeral constructions, given that they are in perpetual reconstruction, but which represent the trace and the physical imprint of social organization and cultural practices. Thus, we cannot conceive of the preservation of architectural form and urban organization without the preservation of social practices.
- The palm grove as a tiered garden, with a diversity of crops and varieties of palm trees, and its irrigation system: foggaras, basins, interchanges and canals with their know-how and social practices constitute a closely intertwined set of tangible and intangible heritage to preserve their coherence.

Conclusion

In addition to its organizational structures and social, cultural and religious practices, the Figuig Oasis community has developed a distinctive earthen architecture that materializes their intangible heritage. Consequently, Figuig is an oasis that has preserved exceptional traces of its past that have become tangible heritage assets today.

A number of important architectural and archaeological sites can be found in Egypt, including walled cities, ramparts, watchtowers, mosques, shrines, irrigation canals, without forgetting the rock inscriptions mentioned above. But this heritage is also agricultural and environmental, as evidenced by the water sources, which were the origin of the palaces, the terraced gardens associated with palm trees and its irrigation system. By applying the proposed strategies, the Figuig Oasis can maintain its cultural and environmental balance and achieve sustainability for future generations. This ensures the continuation of the rich cultural and natural heritage of this unique oasis.

The conservation of oasis ecosystems in the Mediterranean region requires a comprehensive and integrated management approach. First, water resources should be protected through sustainable groundwater use, efficient irrigation systems, and pollution control measures. In addition, biodiversity must be preserved by protecting native species and controlling invasive organisms. Sustainable agricultural practices should be promoted to maintain soil fertility and reduce environmental degradation. Efforts to combat desertification and restore degraded lands are also essential for the long-term stability of oasis ecosystems. Furthermore, local communities should be actively involved in conservation initiatives, as their traditional knowledge and participation contribute significantly to sustainable resource management. Finally, continuous monitoring, scientific research, and effective environmental policies are necessary to enhance the resilience of oasis ecosystems against climate change and other human-induced pressures.

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