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# Cultural Heritage Conservation as a Driving Force toward Sustainable Water Management in Djerba Island

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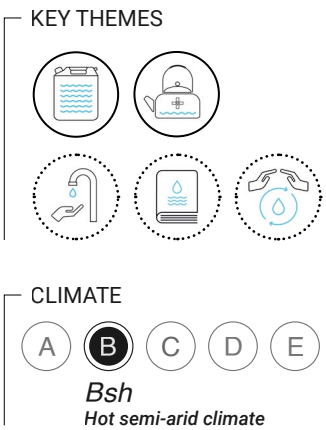
*The island of Djerba is a tourist destination in the semi-arid southeastern region of Tunisia. Especially during peak tourism seasons, it experiences severe pressure on its water supply. Given the island's historical water scarcity, locals have developed solutions to address the shortage, with one of the most notable being the rainwater harvesting and storage system. This system has evolved intricately over time, with meticulous attention to construction details, material selection, maintenance and management strategies. This article posits that embracing and disseminating traditional rainwater harvesting knowledge can play a pivotal role in achieving sustainable water management. It also raises the question of whether fostering cultural heritage through a sustainable tourism orientation, aimed at highlighting heritage, aligns with this objective.*

**Keywords:** *water-scarce islands, rainwater harvesting systems, sustainable water management, water heritage, cultural heritage tourism*



< Fig. 1 Close-up view: View captured from the rooftop of a traditional house (Source: Sarra Ben Youssef, 2023).

**Djerba's Water Challenges**

Djerba has historically grappled with water scarcity. Over the centuries, the island's residents have thrived by fostering a robust ethos of self-reliance, self-sufficiency and a deep respect for the natural environment. Lacking perennial watercourses, their ability to endure has depended on the meticulous collection and storage of rainwater (fig. 2). With only a small number of wells, Djerba islanders have sustained lush homestead gardens, where they cultivate trees and plants for their own consumption (fig. 3). In the traditional pattern, the plants were arranged in tiers to provide each species with protection from the sun and hot winds. At the top were tall palm trees acting as the first canopy, followed by fruit trees like pomegranates, figs, apples, oranges, and lemons forming the second canopy and filtering hot, humid air. Finally, at the bottom were vegetables or cereals, benefiting from the humus and fresh air at ground level (Djerbi 2011). Elisabeth Fentress (2001) explains: "Palms shelter fruit trees, which shelter pomegranates, which in turn shelter little vegetable plots. Wells provide water for these systems, the water trickling into the gardens through tiny channels (*sequia*)."

On the island, traditional knowledge of water management has been passed down through generations via oral tradition, hands-on experience and communal interaction. However, the 1960s marked a turning point as the transmission of this knowledge began to decline amid significant economic and social transformations.

During this period, Djerba underwent notable economic shifts, transitioning into a tourist destination and briefly adopting the cooperative system (Tmarzizet 1993). This reform, spearheaded by Minister Ahmed Ben Salah and President Habib Bourguiba, proved brief and unsuccessful, pushing retail trade into cooperatives and transforming merchants into employees (Bernard 2002). Prior to this reform, Djerbans had successfully operated small-scale businesses, showcasing their entrepreneurial as merchants, weavers, fishers and potters--to name a few prominent occupations (Roulston 1993). Consequently, islanders felt their economic independence threatened by the cooperative system, which restricted their earnings to cooperative wages (Bernard 2002). Many islanders chose to seek opportunities elsewhere to maintain their autonomy, leading to their departure and establishment of new businesses in different locations (Tmarzizet 1993). While Djerbans (both Ibadi and Jewish) departed, migrants from the mainland arrived to work in the burgeoning construction and tourism sectors, contributing to the dynamic socio-economic landscape of Djerba.

In the wake of their departure, homesteads were abandoned and irrigation systems neglected, contributing to the decline of once-prosperous gardens and infrastructure. In subsequent decades, these assets deteriorated further as heirs fragmented large estates into smaller parcels. The smaller plots often became the site of vacation villas, exacerbating the informal tourism sector's lax approach to water management.

Local people who remained on the island continued to uphold traditional practices, recognizing the long-term value of investments like cisterns for both financial and ecological sustainability. Also, some members of the Djerban diaspora have taken steps to rehabilitate ancestral estates, reintroducing traditional water management methods such as the irrigation system (*sequia*) and rainwater cisterns (fig. 4).
In 2017, tourism accounted for 25 per cent of the island's water consumption provided by the National Company for the Exploitation and Distribution of Water, a rate notably higher than

^ Fig. 2 Courtyard of a mosque, Djerba, where rainwater is collected and stored. This photograph depicts several underground cisterns employed for rainwater collection (Source: Sarra Ben Youssef, 2023).

^ Fig. 3 View captured from the rooftop of a traditional house (Source: Sarra Ben Youssef, 2023).

what has been reported for other Mediterranean destinations, with an average consumption of 766 liters per guest per night, a figure raising concerns (Wood et al. 2018). Despite the presence of a desalination plant which began operating in 2018 and has reduced the volume of water piped from the mainland, helping to satisfy the island's fresh water requirements (Ajala et al. 2022), water shortages persist. When confronted with these shortages, residents often resort to fast, low-cost solutions lacking sustainable value. This reliance on temporary fixes often results in increased use of plastic tanks.

The erosion of traditional water management practices diminishes the island's resilience and ability to cope with water scarcity. Preserving these practices is crucial for long-term sustainability in Djerba, as they not only mitigate water shortages by reducing reliance on piped water but promote a cultural ethos of responsible water consumption.

**Water Management Heritage**

Water management heritage in Djerba includes three key aspects. First, the technical elements involve constructing and maintaining rainwater cisterns, wells and irrigation systems. Second, the management strategies of Djerba's residents emphasize self-sufficiency, with individuals taking steps to collect and conserve water for their personal use, alongside a community-driven approach to building and maintaining charity rainwater cisterns to ensure access to water for all. Finally, knowledge transmission plays a vital role, with the teaching and sharing of water management techniques through oral tradition, hands-on experience and community interaction. In this way islanders ensure the continuity of water management knowledge and skills for future generations and preserve the island's water heritage.

In the ancient city of Meninx, the aqueduct and cistern complex were notable features (Ritter and Ben Tahar 2020). Residential buildings, sanctuaries and commercial buildings were equipped with cisterns, suggesting a sophisticated water management system within the urban landscape. Archaeological excavations have revealed the presence of cisterns in the macellum located near the coasts, a cistern and a large water reservoir in a bath complex, a cistern in a temple and subterranean cisterns in residential buildings (Ritter and Ben Tahar 2020). Although Meninx was eventually abandoned, islanders have continued to utilize impluvium cisterns to harvest and store rainwater

^ Fig. 4 A public rainwater cistern for charitable purposes, Feskia type (rectangular with impluvium) (Source: Sarra Ben Youssef, 2023).

in both residential and public buildings.

In the past, each building, whether public or private (including houses, homesteads and mosques), had one or multiple cisterns. Even the countryside gardens, where islanders would spend only certain short periods of the year for agricultural purposes and which did not have built houses, had their cisterns (Tlatli 1942). Rainwater collected in cisterns was never used for irrigating fields (Reiss 1980). These cisterns, all of which were underground, varied in morphology, as well as in their management and ownership status. Rainwater was collected on flat surfaces, used as an impluvium, and from the roof of the house. The water collected from the roof was then channeled through gargoyles onto the sloping blanquettes that typically encircled the *houch* (traditional house) before being directed to the cistern. The surfaces used for water collection were regularly coated with lime to ensure a watertight and hygienic process of conserving potable water (Djerbi 2011). There were different types of cisterns in terms of ownership: domestic cisterns built within houses (thus privately owned), public cisterns built by the government in public spaces to enable islanders to "recharge" their domestic cisterns in times of drought or simply to obtain potable water when their own cisterns were dried out (Tlatli 1942). Islanders were also able to obtain water from "charity cisterns" built by fellow islanders, often located near or around mosques (Amayed 2023).

**Using Water Heritage to Mitigate Water Challenges**

The individual rainwater collecting system, regarded by locals as significant ancestral knowledge, has deep cultural roots within the community. In 2023, Djerba was inscribed on the UNESCO World Heritage list. Many of the proposed monuments on this list, including mosques and some *houch*, feature their own cisterns.

These cisterns can serve as a renewable source of fresh water. They offer a way for locals to meet their water needs during shortages, particularly during the high tourism season when water consumption peaks. The government is promoting the adoption of private rainwater cisterns nationwide through the implementation of two laws regulating their use:

- Decree n° 2016-1125 of 22 August 2016: The National Home Improvement Fund can assist in financing the construction of a rainwater cistern for low-income households. This law specifies that the interest rate, the amount of the fund and the repayment period are calculated based on the monthly income of the beneficiary.

- Decree n° 2018-171 of 19 February 2018: This law regulates the construction and use of rainwater harvesting and storage tanks, as well as their maintenance. It stipulates that the rainwater must be tested at least once a year by a laboratory that specializes in this work. Anyone who wants to build a rainwater cistern must sign a written commitment agreeing to these stipulations when submitting a building permit application.

However, while the construction of a rainwater cistern is a good long-term investment (not only as a sustainable solution to reduce reliance on desalination plants, which consume large amounts of energy, but also to mitigate water shortages), they remain costly to build and, more significantly, they are costly to maintain, particularly for people with low incomes.

In alignment with national policies aimed at enhancing the diversity of tourist attractions, including a focus on sustainable heritage tourism, the Destination Djerba Management and Promotion Organization, in collaboration with municipalities in Djerba and interested locals, are working to incorporate *menzels* (traditional homestead compounds) with cultural significance into the tourist and cultural circuit.

Sustainable cultural tourism, which highlights heritage and integrates cultural sites into tourist activities, offers a promising avenue for preserving and continuing traditional methods of water management in Djerba. Converting heritage locations into guest houses that feature traditional water-saving technology, like rain cisterns, is a practical step toward this goal. These initiatives facilitate the oral transmission of heritage, hands-on experiences, and communal interactions. For example, converting heritage sites into guesthouses requires various elements, including cisterns, to be restored. This work entails the transfer of knowledge, giving those involved a deeper understanding of traditional water management techniques and practices. Consequently, spreading this knowledge helps raise awareness and motivates a shift toward more sustainable water management. Moreover, using tourism to promote sustainable water management techniques offers a strategy to address the water issues that tourism amplifies. This approach repositions tourism from being a contributing factor to water scarcity to becoming part of the solution.

## Conclusion

Djerba islanders have an inspiring heritage of resilience in the face of water scarcity. They should be empowered to be self-reliant through knowledge sharing. Sharing information about traditional water management can help people make informed decisions about water and participate in mitigating water challenges. This approach not only aligns with the cultural heritage of Djerba but also revitalizes its essence, emphasizing the significance of communal involvement and responsible water resource management.

### Policy Recommendations

- Traditional water management heritage, both its technical and cultural aspects, should be encouraged. In addition to preserving ancestral knowledge and practices related to water management, it is important to promote their adaptive reuse in contemporary contexts. Sharing knowledge of what has worked in the past can empower stakeholders to make informed decisions regarding sustainable water management practices in the present and future.

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