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LEGAL MECHANISMS FOR THE PROTECTION OF FOGGARA IN ALGERIAN LEGISLATION

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ABSTRACT

The foggaras are one of the oldest traditional ways to use groundwater in Algeria. They have helped oasis communities stay stable for hundreds of years and made sure that water is safe in dry areas. What makes it unique is that it combines the technical side of irrigation sciences and hydraulic engineering with the social and cultural side that makes it an intangible heritage of value to civilization. But this system is now vulnerable to a number of problems, including desertification, drought, and the random drilling of mechanical wells, as well as the decline of traditional ways of keeping things in good shape. In this context, the legal framework becomes crucial for safeguarding and ensuring the sustainability of the foggaras, as the involvement of the Algerian legislator is evident through various texts pertaining to water, the environment, and cultural heritage, alongside international obligations to preserve intangible heritage. This overlap shows how important it is to combine irrigation sciences, which offer technical solutions, with law, which provides regulatory and institutional tools, to protect the foggaras as an important water source and a symbol of cultural identity.

Keywords: Foggara, water resources, desert oases, local traditional practices, legal protection.

INTRODUCTION

The foggaras are one of Algeria's oldest traditional systems. The people who lived in the desert came up with them to deal with water shortages and harsh drought conditions. They used simple but effective engineering methods. They are not just underground pipes for moving water; they are also a complete social and cultural system on which the oases were built. Thanks to them, traditional ways of life have lasted for hundreds of years. The foggaras are an important resource for making sure there is enough water because they are valuable to the environment and the economy. They are also an important part of our cultural and historical heritage because they show how people have adapted to

living in the desert. However, this old water heritage is no longer safe from danger. It is currently facing a worrying decline because of climate change (desertification and drought), modern practices that are not sustainable (random drilling of mechanical wells), and the fact that traditional methods of keeping and running the qanats are not very strong. And this brings us to the most important question: Is the cultural heritage status of the foggaras enough to keep them alive, or do they need a strict legal framework to make sure they are safe in a long-term development plan? This question gets to the heart of the matter, which is looking at the legal ways that Algerian law protects the Fakarat. The legislator did not provide a specific text defining or regulating the foggaras; however, he implicitly addressed them through a series of texts pertaining to water, cultural heritage, and the environment, as well as Algeria's international obligations in the preservation of intangible heritage.

Consequently, the examination of the legal framework regulating the foggaras transcends mere textual analysis; it seeks to evaluate the capacity of legislation to harmonize the safeguarding of this traditional system as a communal water resource with its conservation as an emblem of cultural identity and historical remembrance. Consequently, the primary issue manifests as the following inquiry: To what degree has Algerian legislation effectively safeguarded Foggara, ensuring their environmental sustainability and cultural heritage contemporary challenges?

To respond to this inquiry, the study examines two principal dimensions: the conceptual and historical framework of vertebrates, and the legal and institutional framework for the protection of the Foggaras in Algeria.

THE CONCEPTUAL AND HISTORICAL FRAMEWORK OF FOGGARA

Definition of Foggara and Their Importance

The legal and practical definition of Foggara

Traditional water management systems in Algerian desert sanctuaries are known as Foggara. They are regarded as a component of water-related cultural heritage, which is legally safeguarded by national water-related legislation. In reality, Algerian lawmakers have not explicitly defined Foggara; rather, they are recognized indirectly through legal texts that regulate water and cultural heritage. Thus, they are safeguarded within the broader context of the preservation of water resources and traditional practices that are linked to cultural heritage. This acknowledgment guarantees their sustainability and recognizes their environmental, social, and cultural significance. Consequently, Foggara can be defined as traditional installations and practices that are designed to collect and distribute surface and groundwater among local communities. These practices are under legal protection in accordance with the Algerian Water Law (Articles 30–53 of Law No. 05-12 of 4 August 2005 on Water) and are part of a social organization that ensures equity and solidarity.

According to Remini et al (2010), Foggara are conventional groundwater distribution systems that are frequently implemented in arid regions like Touat, Gourara, and Ghardaïa. They are an integral component of Algeria's water-related cultural heritage and serve as a testament to human ingenuity in adapting to harsh arid conditions. Foggara have been assigned multiple definitions. Some researchers characterize them as "traditional installations for collecting groundwater."

Foggara is "a traditional water system based on a horizontal gallery equipped with vertical shafts or wells, used for collecting and distributing water. They derive water from diverse sources, such as groundwater at the base of mountains, intermittent rainfall, deep aquifers like the Continental Intercalary, springs, or seasonal floods, etc." (Remini et al, 2010) Moreover, the UNESCO (2003) Convention for the Safeguarding of the Intangible Cultural Heritage provided a broader definition, considering it to include all practices, representations, expressions, knowledge, and skills—as well as instruments, objects, artifacts, and cultural spaces associated therewith—that communities recognize as part of their heritage.

Thus, Foggaras are not only hydraulic structures for water distribution; they embody a whole collection of inherited local knowledge, including digging techniques, slope calculations, water share allocation, and processes for settling water disputes among oasis communities.

Linking law with practice is of tremendous importance. Legal protection assures the continuity of these systems, while traditional local organization preserves their efficacy and sustainability.

The Algerian Water Law prioritizes fair use rights and water resource preservation, hence maintaining the resilience of Foggara as a vital factor in conserving traditional water heritage.

The importance of Foggara in local development and water security

– Their relevance in promoting local development

The Foggara system contributes greatly to local development through its environmental, social, and economic aspects. This progress manifests in the consistent supply of water for desert agriculture, particularly palm cultivation,leading to population stability, job creation, and sustainable revenue. It also stresses the significance of Foggara in maintaining environmental and cultural heritage, with the possibility to strengthen this function by integrating modern technology like as solar energy systems to raise productivity and minimize expenses.

- Agricultural and economic development

Undoubtedly, Foggara are not only water channels; they represent the backbone of agricultural and economic development in the Sahara. They secure the water essential for agricultural development, especially palm farming, while also producing sustainable

sources of revenue for local residents (Robles et al., 2023). This enhances settlement stability and preserves environmental and social heritage.

Accordingly, Foggara contribute to population stability and the preservation of environmental heritage by ensuring water supply and sustaining desert agriculture, particularly when integrated with solar energy technologies (Laaboudi et al., 2022), which enhance agricultural productivity and reduce costs. The R'gan initiative in southern Algeria stands out as a model integrating traditional knowledge with innovation to promote sustainable local development.

– Social and cultural dimensions

Foggara are not just hydraulic constructions or pillars of agricultural and economic development in the Sahara; they are also cultural and social spaces that enhance community togetherness. They conserve traditional knowledge and serve as an economic resource through sustainable tourism.

– Environmental Sustainability

Foggara rely on natural slope and gravity to transfer water (Laaboudi, et al., 2022), ensuring constant flow without pumps or external energy. This decreases fuel use, pollutants, and unnecessary pumping. Moreover, the sluggish flow helps protect groundwater supplies and allows for natural recharge, hence limiting pollution. As such, Foggara provide an environmentally viable strategy for water resource management in dry environments.

Foggara also reduce groundwater overexploitation by maintaining ecological balance. A research in M'ghaer, Timimoune, Adrar Province, demonstrated that excessive exploitation of wells causes groundwater depletion, compromising the sustainability of Foggara and leading to their drying up, mostly owing to unregulated management of water resources (Mohamed and Remini, 2017).

- Challenges facing Foggara

Despite its environmental and social value, Foggara suffer various obstacles, the most notable of which are:

Drought and climate change

Low rainfall and rising temperatures restrict groundwater recharge and increase evaporation, hence decreasing the potential of Foggara to regenerate (Remini, 2008).

In other words, decreased rainfall and rising heat reduce groundwater recharge rates and increase evaporation, decreasing accessible water reserves and limiting the capacity of these ancient conduits to continue working. This challenges their sustainability as a key water supply in desert locations.

Intensive use of wells and modern technology

Excessive reliance on deep wells and mechanical pumps is a key issue to the Foggara system. Deep drilling facilitates the quick extraction of vast amounts of water, while pumps remove water at rates exceeding natural recharge of aquifers (Mohamed and Remini, 2017). This increased depletion decreases groundwater levels, reduces the natural flow of Foggara, and undermines the balance and long-term sustainability of traditional water systems.

Modern wells and pumps therefore damage Foggara systems, and may even cause them to dry up or collapse. Comparable concerns have been noted in other qanat systems, such as those in Iran and Morocco (Abbasnejad and Behnam, 2019).

Maintenance and financial shortages

finance and experience weaken the maintenance of Foggara, resulting to tunnel collapses, blocked channels, and sand accumulation, which limits water flow and might cause contamination.

Migration and social change

Population loss in oasis or transitions from traditional agriculture to intensive farming or other occupations reduce social engagement in Foggara preservation. This damages their continuity and risks their survival.

As stated by Idda et al. (2021), lack of financial resources and knowledge results in poor maintenance, collapses, and obstructions due to sand accumulation. Combined with population movement and socio-economic transformations, these problems weaken reliance on Foggara and undermine their position as part of Algeria's traditional water heritage.

From the above, it is obvious that Foggara are among the most significant traditional systems for managing water resources in Algeria's desert oases. They embody inherited technical knowledge and local social mechanisms that promote equitable and sustainable water delivery.

However, these conduits face increased challenges induced by drought, climate change, migration, and socio-economic upheavals. Their continuity has therefore become closely tied to the effectiveness of their legal and regulatory protection, as an essential tool for preserving this living water heritage and ensuring its sustainability—while adapting to modern development needs without undermining traditional values of cooperation and community solidarity.

The Importance of Foggara in Water Security

Foggaras are of increasing importance as traditional water systems in the Algerian Sahara, particularly in the face of intensifying climate issues such as drought and decreased

rainfall. They offer a unique combination of sustainability and efficient water transportation, together with effective local community participation in water resource management. The foggara represents a vital mechanism for the preservation and sustainability of water resources, as it contributes to securing regular water supplies through traditional techniques adapted to the desert environment. This makes it a key element in combating drought and strengthening water security.

Continuous supply of quality water

The foggara ensures the provision of pure and steadily flowing water, since its underground channels protect it from evaporation and pollution (Remini, 2023). This guarantees its availability even during periods of drought.

A study conducted in the Adrar region (Nasri et al., 2022) showed that foggara water is often of high quality, making it suitable for both drinking and irrigation. However, monitoring of pollution and salinity levels may sometimes be necessary.

Regulation of use and equitable distribution

Desert communities utilize customary systems for water allocation, based on time or cultivated land area, assuring fairness and decreasing conflicts (Remini and Achour, 2013). In other words, these communities split foggara water according to local traditions that set time-based or land-based shares for each user, attempting to assure fairness and avoid disagreements.

The effectiveness and sustainability of water distribution thus rely on a traditional administrative system (Idda et al., 2021), overseen by a local council that allocates shares and supervises distribution and maintenance collectively.

This is consistent with the field studies of (Ostrom, 1990), who confirmed that local communities are capable of establishing flexible and effective rules for self-managing their resources, as highlighted in her well-known book *Governing the Commons* (1990).

In her study, she created the “Eight Principles of Ostrom,” which outline the criteria for successful and sustainable resource management, such as clearly defined boundaries, user engagement in rule-making, monitoring mechanisms, and graded sanctions. These ideas were then applied by various scholars, including Remini and Berramdane, among others, to investigate the foggara system (Idda et al., 2021).

They regarded it a practical illustration of what Ostrom characterized as a local self-organizing system that creates water distribution regulations, monitors compliance, and changes infrastructure when necessary. This underlines the efficacy of local communities in sustainably managing common natural resources utilizing self-governance and customary rules, a concept that clearly applies to the foggara system.

HISTORICAL ORIGINS OF THE FOGGARA IN ALGERIA AND TRADITIONAL TECHNIQUES

Historical origins of the foggara and traditional techniques

Historical origins

The historical roots of the foggara, as a traditional water system, are attributed by some experts to the ancient Persian culture, known as the qanats, which arose more than 3000 years ago. It was later brought into North Africa through cultural contacts and Islamic conquests (Sutherland, 2020).

The foggara played a significant part in developing oasis settlements by providing the water that created the foundation for sustainable human habitation. For this reason, it has been recognized as endangered cultural heritage (Remini, 2014).

Traditional technique

In practice, the foggara is an ancient technology that uses groundwater through underground tunnels and distributes it toward agricultural oases. It comprises of various fundamental components, listed as follows:

- Mother well (head of the foggara): The point from which water begins to flow.
- Horizontal underground tunnel: Extends for several kilometers, protecting the water from desert heat and evaporation.
- Vertical shafts (air vents): Dug along the tunnel for ventilation and maintenance, appearing on the surface as a line of circular pits.
- Distribution basins (dividers): These divide the water upon reaching the oasis according to a fair customary system based on time and cultivated area (Remini et al., 2017; Remini et al., 2014).

Origins of the foggara in Algeria: Between the Water, Cultural, and Social Dimensions

The genesis of foggaras in Algeria extends back to the medieval Islamic period, when it is thought that the first of these systems developed in the oasis of Tamanrasset through "Foggara Hannou," reported to be centuries old. Initially, it was merely a well before being changed into a mature qanat-type system (Capot-Rey, 1953).

Accordingly, their growth in Algeria was related to the wide southern regions like as Touat, Tidikelt, and Gourara, acting as a critical means of utilizing groundwater in the difficult desert environment. This contributed to the rise of oases and the settlement of humans in them (Remini et al., 2014).

Over time, foggaras evolved in these regions and came to be used as traditional systems for collecting and distributing water in Algerian desert oases. They were thus considered part of the cultural water heritage that enjoys legal protection under national water legislation (Benbousta, 2018).

Recent studies show that foggaras are still used in some areas, such as the Lahmar oasis in Touat, where they are now supplied with water through pumping. This demonstrates the ability of local communities to adapt to environmental changes and modern technologies (Salem et al., 2017).

Thus, foggaras are a sustainable model for water resource management in arid environments, representing a combination of traditional knowledge and modern techniques that contribute to the preservation of Algeria's cultural and water heritage.

The foggara between water, cultural, and social dimensions

Water dimension

The construction and maintenance of foggaras symbolize social solidarity, using traditional tools such as picks, axes, and ropes. Traditional techniques were also applied to increase water discharge, such as widening tunnels or digging new lateral branches (*Traditional techniques…, 2012*).

Cultural and social dimension

The role of foggaras was not limited to water management; they were also tied to customary systems of cooperation and fairness. Local councils, or the *Jama'a,* assumed responsibility for distributing shares and resolving disputes, since water was considered a common resource, whose benefits had to be shared among all (Remini and Berramdane, 2016).

Thus, foggaras developed cultural and social characteristics in addition to their water-related significance. They were recognized as human heritage of worldwide worth, exhibiting remarkable adaptation to the hardship of the desert. They are also part of Algeria's intangible heritage, particularly in the M'zab Valley, where they collect floodwaters and distribute them to palm groves and gardens while guaranteeing ecological and social balance (Madani, 2022).

It is clear that foggaras are a unique symbol of human civilization, combining technical ingenuity with social and cultural dimensions. They must therefore be protected and preserved, as they represent both a natural resource and a cultural identity deeply rooted in Algeria's desert history.

Nevertheless, this traditional water system is currently in sharp decline in Algeria due to multiple factors such as neglect, drought, and the random drilling of mechanical wells (Remini and Achour, 2013).

Traditional methods of water management - local systems for water distribution among inhabitants

The foggara is regarded one of the oldest and most important traditional irrigation methods in Algeria, based on the flow of groundwater through underground channels utilizing only gravity. These systems are predominantly employed in the oases of Touat, Gourara, and Tidikelt, where the total length of foggaras is estimated at over 2000 kilometers (Alfonso, 2022).

The foggara system consists of a gently sloping underground tunnel that diverts water from an aquifer located above the valley toward dry plains below, finally reaching palm groves. These channels are dug at a depth of 5 to 10 meters below the surface (Idda et al., 2021), and they extend for 2 to 15 kilometers with a gentle slope that ensures water flow toward its target.

Despite their modest diameter, the galleries are large enough to provide access for the miqyas worker, the water measurer responsible for digging tunnels, channeling water, and assuring the foggara's continued operation. Once the water rises to the top, it is disseminated through the kasriya, a "comb" made up of holes of varied sizes, which splits the water into smaller channels heading to agricultural fields (Benbousta, 2018).

Recent research shows that foggaras are not merely technical systems, but rather living socio-technical systems that adapt to environmental and social changes. This was confirmed by the analysis of Idda et al. (2021), which demonstrated how local communities in Algerian oases have preserved foggaras by adapting the institutions that manage them, thereby ensuring their sustainability in the face of contemporary challenges such as drought and climate change.

Similarly, Idda et al. (2017) highlighted that foggaras embody the design principles proposed by Ostrom (1990), such as clearly defined resource and user boundaries, rules tailored to resource characteristics, and the ability to adapt to environmental and social changes.

Algerian researcher Remini (2016) also pointed out in one of his studies that foggaras represent the most prominent traditional model of water management in Algeria, as this system combines technical efficiency with social norms, thereby reflecting the capacity of local communities to distribute water equitably while safeguarding water resources over the long term.

Thus, foggaras stand as a prominent example of shared water resource management, where local communities demonstrate an ability for self-organization and adaptation to changes, which enhances the sustainability of these traditional systems over time.

Based on the above, it becomes clear that foggaras are among the most significant traditional systems for managing water resources in Algeria's Saharan oases, as they represent an extension of inherited technical knowledge and local social systems that ensure fair and sustainable distribution of water. Despite the increased obstacles these underground routes face, such as drought, climate change, migration, and socioeconomic

transformations their survival has become increasingly related to effective legal and regulatory protection. This protection serves as a crucial tool to maintain this living water legacy, assure its survival, and adapt it to the requirements of modern development, without undermining the traditional values and principles based on cooperation and community solidarity.

THE LEGAL AND INSTITUTIONAL FRAMEWORK FOR PROTECTING FOGGARAS IN ALGERIAN LEGISLATION

The legal basis for protecting traditional water resources in Algeria, especially *foggaras*, is grounded in a set of constitutional principles, international conventions, national legislation, and procedural rules. These collectively provide the framework for regulating, utilizing, and protecting water resources. Below we examine the most important of these principles and rules as found in the Constitution and relevant laws.

Constitutional foundations and international treaties as a basis for the protection of traditional water resources (Foggaras)

Constitutional foundations and legal principles as a basis for the protection of traditional water resources (Foggaras)

Constitutional foundations

The Algerian constitutional legislator, through the 2020 constitutional amendment (ratified by referendum on November 1, 2020, and published in the *Official Gazette of the People's Democratic Republic of Algeria* under Presidential Decree No. 20-442 dated December 30, 2020, Official Gazette No. 82, December 30, 2020), enshrined the right to a healthy environment. This reinforces the State's commitment to protecting natural resources, especially traditional water resources.

Article 63 stipulates: "Every person has the right to a healthy environment within the framework of sustainable development."

Likewise, Article 21(2) of the same amendment affirms: "The State guarantees the protection of national cultural heritage, both tangible and intangible." This stems from the recognition that foggaras form an integral part of Algeria's cultural heritage, which the State is duty-bound to protect.

The preservation of the foggara system also falls under the principle of sustainability and environmental balance, as articulated in Article 64 of the Constitution, which obliges the State to maintain ecological balance and preserve natural resources. This aligns with the sustainable and traditional nature of the foggara system.

Furthermore, this traditional water system enjoys protection from a cultural and historical perspective, confirmed in Article 69 of the same constitutional amendment, which stipulates that the State must protect cultural and historical heritage. This explicitly includes traditional water heritage such as foggaras, considered part of the local heritage

in southern Algeria. Therefore, the *foggara system* is entitled to general constitutional protection.

It is worth noting that the Algerian legislator has provided the necessary constitutional reference points, which can be invoked legally in any attempt to protect foggaras from neglect or destruction.

Legal Principles

Given their fragile nature and reliance on natural balance, foggaras require legal protection suited to their sensitivity as traditional systems for distributing groundwater in oasis regions. The Algerian legislator codified a set of legal principles in the Water Law No. 05-12 (Law No. 05-12 of August 4, 2005, relating to water, Official Gazette No. 53) that serve as the foundation for protecting this system. The most important include the following:

- The Principle of Sustainability: Enshrined in Article 1 of Law No. 05-12, which emphasizes that water resources must be managed within the framework of sustainable development, thereby ensuring the longevity of foggaras, which cannot withstand intensive exploitation.

- The Principle of Protection from Pollution and Depletion: Affirmed in Articles 30 and 31 of the same law, which require preventive measures and the establishment of protection zones in cases of depletion risk. Article 46 prohibits pollution of water or channels, thereby protecting foggaras from activities harmful to hydrological balance.

- The Principle of Local Participatory Management: Established in Articles 56 and 63 of Law No. 05-12, which promote the involvement of local communities in planning and managing water resources. This is an explicit recognition of the role of oasis communities and their traditional expertise in managing foggaras.

- The Principle of Public Utility: Codified in Article 85 of Law No. 05-12, which regulates water use and prevents monopolization. This ensures that the collective nature of foggara water is safeguarded against individual appropriation.

Taken together, these principles form a legal framework that guarantees the protection and sustainability of foggaras by linking traditional practices with modern legislation.

International treaties and conventions as a basis for the protection of traditional water resources (Foggaras)

Pursuant to Article 132 of the 2020 Algerian Constitution, which specifies that “ratified treaties shall prevail over the law,” Algeria has ratified various international treaties and conventions that have been incorporated into the national legal framework. These tools can be used before courts or used as grounds to contest measures that impair the environment and water resources, especially groundwater.

Consequently, under these treaties, the State is obligated to take the necessary steps to protect the environment and natural resources. Among the most relevant conventions in this context is the 2003 UNESCO Convention for the Safeguarding of Intangible Cultural Heritage.

For the Safeguarding of the Intangible Cultural Heritage, adopted on October 17, 2003, this convention is by far the most significant, serving as a pivotal international framework for the protection of intangible heritage, "traditions, cultural expressions, knowledge, and skills"—which form part of the cultural heritage of local communities. Although it normally encompasses elements submerged under water only when linked to cultural activities associated to water, Algeria ratified it in March 2004, thereby allowing its principles to be included into national plans for conserving living heritage.

The importance of this convention lies in its recognition that intangible cultural heritage is not confined to symbolic or ceremonial aspects, but also encompasses traditional knowledge related to the management of natural resources, including traditional water distribution systems such as the foggara, which is particularly widespread in southern Algerian regions such as Timimoun and Adrar.

According to Article 2 of the convention mentioned above, intangible heritage includes "knowledge and practices concerning nature and the universe," a phrase that allows the *foggara* system to fall under the scope of protection established by Article 2, given that it represents a blend of "knowledge concerning nature and the universe" (Article 2, paragraph (d)), in addition to the category of "skills related to traditional craftsmanship" (Article 2, paragraph (e)). Thus, the system qualifies for both national and international safeguarding, on the basis of its classification as intangible cultural heritage.

This approach was further reinforced by the adoption of a joint UNESCO document (2023) entitled *"Traditional Water-Sharing Systems in the Oases,"* which was inscribed on the Representative List of the Intangible Cultural Heritage of Humanity in December 2023

This recognition was achieved through cooperation between Algeria and several Maghreb countries, with the *foggara* system considered one of its central pillars.

Basic legislation in Algeria for the protection of the Foggara

Law No. 98-04 on the protection of cultural heritage

Law No. 98-04 (Law No. 98-04 of 20 Safar 1419 equivalent to June 15, 1998, Official Gazette No. 44) represents the fundamental legislative framework in Algeria for the protection of cultural property in all its forms, both physical and intangible. The foggara falls under its scope as part of the national cultural legacy, being a conventional immovable construction acquired from past civilizations, and so classed as "cultural real estate heritage." It is also considered part of the "intangible cultural heritage" because of the traditional knowledge and social practices it embodies, including construction

techniques, maintenance methods, and customary systems for water distribution (Article 2 of Law No. 98-04 on the Protection of Cultural Heritage).

Although the legislator considers the foggara as cultural property under Article 2 of this law, its management is assigned to specific regulations according on the nature of ownership, as confirmed by Article 4 of Law No. 98-04. Thus, foggaras are administered in accordance with Law No. 90-30 on National Property (Law No. 90-30 of 1 December 1990, revised and supplemented by Law No. 08-14 of 20 July 2008), with due consideration for their heritage character, whether they are under the private property of the state or municipal authorities. If they are held as waqf (endowment), their management is governed by Law No. 91-10 on Endowments (Law No. 91-10 of April 27, 1991, revised by Law No. 01-07 of May 22, 2001, and Law No. 02-10 of December 14, 2002). In all situations, their original purpose and cultural worth must be protected, and any activity that affects its historical or social value is prohibited (Article 4 of Law No. 98-04).

Furthermore, Articles 10 to 16, Article 59, and Articles 94 to 102 of Law No. 98-04 establish clear mechanisms for protecting such structures, including inventory, classification on the national heritage list, subjecting restoration or alterations to prior authorization, and imposing sanctions in cases of damage or neglect.

This shows that the Algerian legislator, through the Cultural Heritage Law, has established a solid legal foundation to safeguard the heritage value of the foggara, protect it from degradation or encroachment, and oblige both the Ministry of Culture and competent local authorities to intervene in matters relating to its maintenance or rehabilitation.

Law No. 05-12 on water

Law No. 05-12 on Water (Law No. 05-12 of August 4, 2005, Official Gazette No. 52) is a crucial legislative reference for the protection of traditional water management systems, particularly the foggara, in arid and semi-arid regions. It is also the principal legislative framework in Algeria governing the use, sustainability, and management of water resources.

The Algerian parliament, under this law, stressed the protection of water resources from contamination and overexploitation. Several provisions underline the need to rationalize water use, protect existing hydraulic structures, and recognize traditional and local management techniques. Accordingly, foggaras may be considered as “private water structures or those of local utility” requiring protection and upkeep.

Article 3 of the law states that water constitutes a “national interest that must be protected and used rationally,” reaffirming its status as a strategic national resource to be managed sustainably.

Article 15 stipulates that all water structures, “including traditional ones,” must be preserved and maintained, and that no modification or destruction may occur without legal authorization.

Article 77 imposes sanctions on anyone who damages or alters the functions of water installations, whether traditional or modern.

The law also provides for monitoring mechanisms and sanctions against unlawful or unauthorized uses of water resources (Article 118).

Importantly, the legislator established a system of "Water Police (police des eaux)" inside Law No. 05-12. Articles 26 to 29 offer powers of intervention and oversight to specialized bodies, combining preventive and penal actions. This system sets strong legal penalties for acts injurious to water resources, such as unlawful withdrawal or contamination, thereby showing the legislator's knowledge of the hazards posed to water security. The "Water Police" thus works as a legal tool with both punitive and preventive elements to preserve this critical resource against groundwater and surface water overexploitation and wasting.

The law thus establishes a legal framework for controlling interventions on the foggara system and specifies rules for its use or restoration, providing protection from encroachment or technology modifications that would strip it of its traditional identity and original purpose.

Law No. 03-10 on environmental protection in the context of sustainable development

Although Law No. 03-10 on July 19, 2003 (Law No. 03-10 on Environmental Protection) does not mention the foggara specifically, it offers a legal framework for the protection of water resources and ecosystems. It encompasses the security of natural resources (Article 4), the preservation of biodiversity (Article 48), the formation of protected areas (Article 59), and imposes culpability and penalties for infractions (Articles 65 and 108).

It also contains practical measures such as environmental impact assessments prior to development projects and collaboration among various organizations (Article 72). Collectively, these provisions help indirectly to the conservation of foggaras by preserving the viability of traditional water systems and natural equilibrium in oases and dry zones.

Executive decree No. 21-260 on the procedures for granting permits for the use of water resources

Although Executive Decree No. 21-260 of June 13, 2021 (amending and supplementing Executive Decree No. 08-148 of May 21, 2008, on the procedures for granting permits for the use of water resources) does not explicitly mention foggaras, its provisions implicitly apply to them as traditional groundwater exploitation systems.

Any use of water resources, including foggara water, requires an exploitation authorization given by the provincial directorate of water resources in compliance with the decree's provisions. The application must describe the type of structure, so allowing foggaras to be legally included among protected traditional installations. Importantly, the

decree safeguards customary and historical rights of local people, making it a legal instrument to protect foggaras from intrusion or illicit exploitation.

Thus, the implicit application of Executive Decree No. 21-260 to foggaras provides them with legal protection while assuring respect for traditional rights.

CONCLUSION

The examination of the legal framework regulating Foggara indicates that the Algerian legislator has not established explicit provisions for this traditional system. However, laws about water, the environment, and cultural heritage deal with its parts in an indirect way.

While these texts establish a general legal framework for the protection of Foggara, their efficacy is constrained by modern challenges, including desertification, drought, and the unregulated drilling of mechanical wells, compounded by the deterioration of traditional maintenance systems.

Thus, it can be said that just recognizing Foggara as cultural heritage is not enough to make sure they survive. Instead, a clearer and more complete legal framework is needed, one that balances their importance as a source of water and as intangible cultural heritage.

A set of suggestions and recommendations comes up to help find this balance:

- From a legal standpoint, it is necessary to include specific provisions regarding Foggara in either the Water Law or the Cultural Heritage Law. These provisions should define Foggara and create ways to protect and maintain them. Local institutions, like municipalities or water agencies, should be in charge of making sure these laws are followed.
- From a technical point of view, this means using modern irrigation science to restore and maintain Foggara by doing precise hydrological studies and using sustainable engineering methods that keep their traditional structure while reducing water loss.
- From an institutional standpoint: Creating collaborative initiatives between the Ministries of Water Resources, Environment, and Culture, alongside universities and research institutions, to enhance the safeguarding of Foggara as both cultural heritage and vital water resources.
- From a societal perspective: Involving local communities in protection efforts by supporting oasis associations and empowering them with financial and technical resources, given their direct connection to the continuity of this system.

Thus, the success of Algerian legislation in protecting Foggara ultimately depends on its ability to develop an integrated approach combining law and irrigation sciences—an approach that ensures their environmental sustainability on the one hand, and safeguards them as part of the cultural identity and historical memory of Saharan communities on the other.

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