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SOUF (ALGERIA), THE REVOLUTION OF CRATER PALM GROVES (GHOUTS)

LE SOUF (ALGERIE), LA REVOLUTION DES PALMERAIES DE CRATERES (GHOUTS)

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ABSTRACT

For more than seven centuries, a revolution has taken place in the heart of the Grand Erg Oriental. This is an original hydro-agricultural development that originated in the Souf valley. For more than 30 years (Period: 1990-2020), we have traveled the four corners of the Algerian Sahara. Different types of oases were visited. Discussions and surveys were carried out among the Sufi population. It turns out that the palm trees planted in thousands of craters were dug by the Sufis in the middle of the dunes of the Grand Erg Oriental. It was a real revolution led by the Sufi to replace a dune environment (yellow) with a forest of palm trees (green). Unfortunately, this discontinuous palm grove is deteriorating from year to year. More than 50% of the total area has been abandoned. Today, in competition with pivotal agriculture which has classified the Souf valley as an agricultural region par excellence, the Ghout risks being forgotten.

Keywords: Ghout, Discontinuous palm grove, Sahara, Souf valley.

RESUME

Depuis plus de quatre siècles et demi, une révolution de sable a eu lieu en plein Grand Erg Oriental. Il s'agit d'un aménagement hydro agricole original qui a pris naissance dans la vallée de Souf. Durant plus de 30 ans (Période : 1990-2020), nous avons sillonné les quatre coins du Sahara Algérien. Différents types d'oasis ont été visités. Des discussions et des enquêtes ont été effectuées auprès de la population Soufi. Il s'avère que les palmiers plantés dans des centaines de cratères ont été creusés par les Soufi au milieu des dunes du Grand Erg Oriental. C'était une véritable révolution menée par les Soufi pour remplacer un environnement dunaire (jaune) par une forêt de palmiers (verte). Malheureusement, cette palmeraie discontinue se dégrade d'une année à l'autre. Plus de 50 % de la superficie totale a été abandonnée. Aujourd'hui, concurrencée par l'agriculture de pivot qui a classé la vallée de Souf comme une région à vocation agricole par excellence, le Ghout risque d'être oublié.

Mots clés : Ghout, Palmeraie discontinue, Sahara, la vallée de Souf,

INTRODUCTION

The Sahara is the largest and most beautiful hot desert on the planet. A vast expanse with an arid climate covering an area of 8 million km^2 is characterized by low rainfall and temperatures that can exceed 45 °C in summer. In this warm territory; water from sporadic floods evaporates; only a small amount of water seeps into the ground to fill underground aquifers. All the oases have developed around water points (water sources) from groundwater. After these resurgences of water dried up, the oasis inhabitants invented water catchment techniques, each of which takes into account the hydrogeological conditions of its environment. This is how the oases located on the southwestern outskirts of the Great Western Erg were equipped with a foggaras system which consists of irrigating the palm groves. The hydrogeology of the regions of Touat, Gourara and Tidikelt is favorable to the realization of foggaras which is conditioned by the rise in the water level of the water table compared to the ground level of the palm grove (Remini, 2008; Remini, 2011a; Remini, 2011b; Remini, 2017; Remini and Achour, 2016; Remini et al, 2015; Remini et al, 2011). Otherwise, the failure to meet the criteria for the existence of foggaras in the M'zab valley prompted the local population to use animal-drawn wells (called Khottara) (Remini, 2018). The same principle was applied in the Saoura valley and more particularly in the oases of Kerzaz, Igli, Beni Ikhlef, El Ouata, Guerzim and Beni Abbes; the farmers exploited the groundwater by using the pendulum wells (Remini and Rezoug, 2017). In this article, we are interested in the oases of the Souf valley which invented a somewhat original hydro-agricultural development and which adapts well to the hydrogeological conditions of the Soufi environment which is none other than the immense dune sea of the Great Western Erg.

STUDY REGION AND WORK METHODOLOGY

Situation and characteristics of the study region

The oases of Souf located in the heart of the Grand Erg Oriental which is located 600 km as the crow flies south-east of Algiers. Covering an area of 120,000 km^2, the Grand Erg Oriental is an immense sea of sand. It is between the large dunes that the Soufi built their oases.

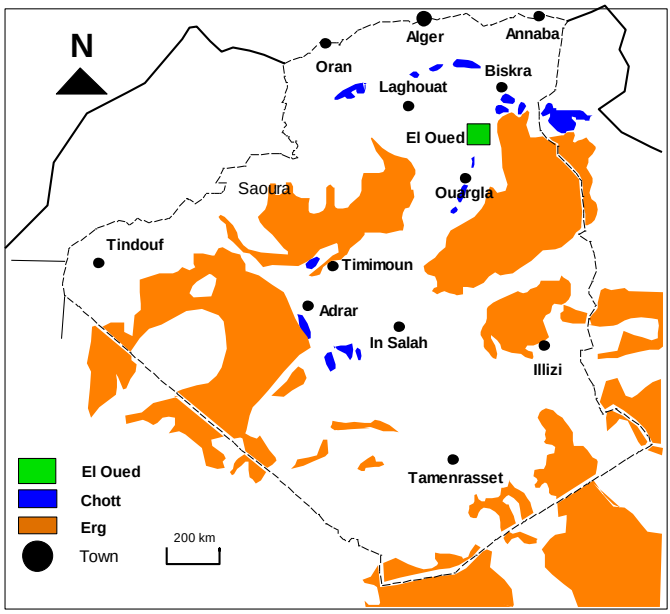


Figure 1: Geographical location of the study region (Remini, 2021)

The water table was the only reservoir that supplied the oases of Souf. It was not until the early 1940s that the Northern Sahara Aquifer System (SASS) was discovered. The Souf valley sits on two large superimposed confined groundwater: the Intercalary Continental and Terminal Complex.

The Souf, a tourist area par excellence is well known for its original architecture typical of the region; the dwellings are equipped with domes to cool the interiors of the houses during periods of high temperatures. Moreover, El Oued; capital of Souf is well known by its name: city with a thousand domes.

Investigations and inquiries

Our research work on Ghouts began in the early ninety when these traditional hydro agricultural systems were submerged by flooding a particular since it is the rises in the water table water during this these work missions that we were impressed by this unprecedented hydro-agricultural heritage. Visits to the Souf oases have been scheduled once or twice a year. Investigations and surveys were conducted with the Soufi people and owners of Ghouts to obtain data and information on Ghouts.

RESULTS AND DISCUSSIONS

The idea of Ghout

Despite very difficult living conditions, the Sufi settled in a sandy region shaped like a basin, so it is a closed environment. The Sufi knows his environment very well and he was aware that under the sand dunes the soil is very fertile and that the water table is not far from the surface of the ground. Based on the hydrogeology of the region and the flow-energy yield, the Sufi had two options to create their palm grove in the middle of the immense sand dunes. Or they go up the water to the palm tree. In this case, we are talking about conventional irrigation (Fig. 2a). Or they bring the palm tree back to the water. We speak in the case of Ghout (Fig. 2b) (Remini, 2019).

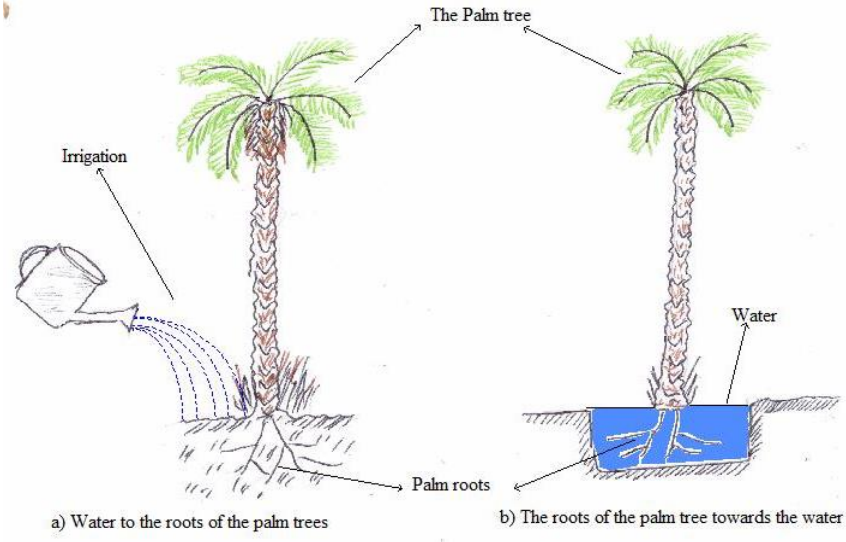


Figure 2: Concept of Gout (Remini, 2021)

The Ghouts: A discontinuous palm grove

The Soufi were well aware that their region is a closed environment and therefore the delivery of drainage water will pose enormous problems. In a closed environment, the development of a continuous palm grove irrigated by water from wells would be a failure (Photo. 1 and 2, Fig. 3a). However, the construction of a discontinuous palm invented by the Soufi which involves building craters in the dunes of the Grand Erg Oriental was a successful project. All of the Ghouts form a discontinuous palm grove (Photo.2 and Fig.3b). In this case, the yield is very high since it is a system with zero energy (0) and infinite irrigation flow. For this type of discontinuous palm grove, there is continuous irrigation; the roots of palm trees are constantly in contact with groundwater. In a discontinuous palm grove, we do not irrigate but we maintain the Ghout.

Photo 1: An aerial view of a continuous palm grove in an open environment (Timimoun oasis) (Google Earth)

Photo 2: An aerial view of a discontinuous palm grove in a closed environment (Souf oasis) (Google Earth)

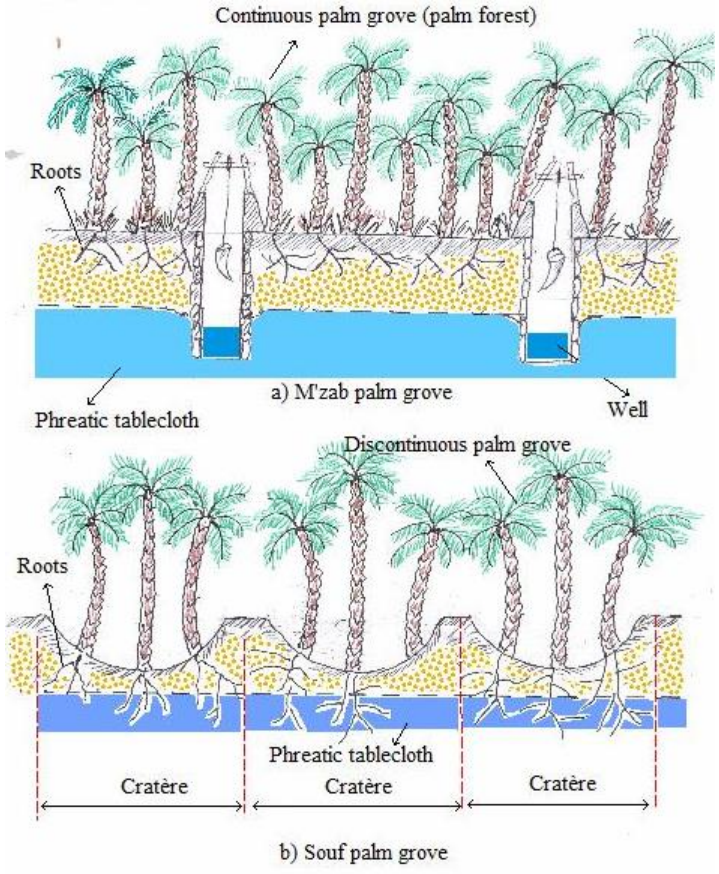


Figure 3: Continuous palm grove - Discontinuous palm grove (Diagram Remini, 2021)

How the Ghout works

The success of the foggara irrigation technique in the regions of the periphery of the Grand Erg Occidental, and more particularly Touat, Gourara and Tidikelt, prompted the Soufi to invent a hydro-agricultural development specific to the Souf region. Unlike the oases of Touat, Gourara and Tidikelt which is an open environment, the Souf valley is a closed environment which in this case requires a closed solution. This is what the Soufi adopted; the palm groves with craters or the Ghout which is a micro-palm grove which ensures its self-irrigation.

A Ghout is a micro-palm grove. All of the Ghout form the discontinuous palm grove. This involves planting palm trees in a crater set up in the middle of the dunes of the Grand Erg Oriental (Photo.3 and Fig. 4). After a painful job which consists in excavating several

tons of sand with rudimentary means, the young palm tree is planted and which initially requires assisted irrigation. A pendulum well is to be provided in a Ghout to irrigate the crops in the garden (vegetables) in order to meet the fruit and vegetable needs of the families of the Ghout owners. After a period of 6 months of irrigation, the roots of the young palms will be in permanent contact with the water from the groundwater. The farmer only takes care of cleaning up the Ghout. The dimensions of the Ghout vary depending on the number of owners. There are small and large Ghouts. All of these craters of different sizes form a discontinuous palm grove.

Photo 3: A general view of a Ghout in the middle of a sea of sand of Grand Erg Oriental (Photo. Remini and Miloudi, 2019)

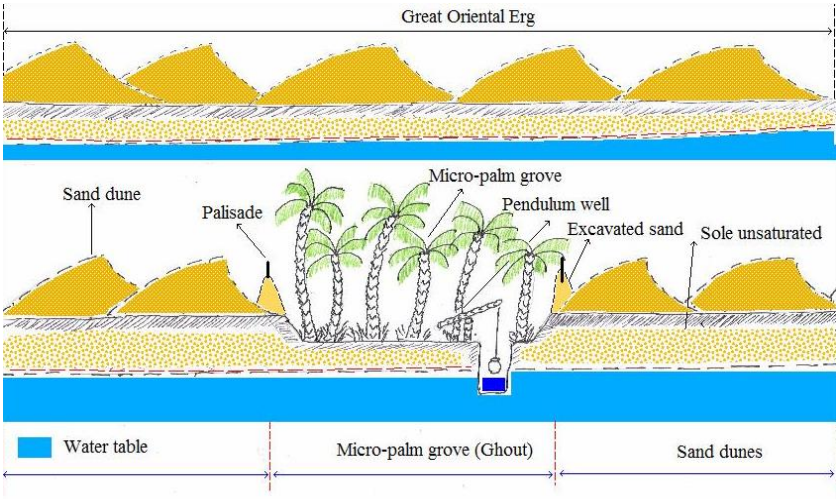


Figure 4: Diagram of a Ghout in the middle of the dunes (Diagram Remini, 2021)

The revolution of the Ghouts

Digging a well in earthen ground is less painful than excavating the same amount of material in a dune environment. Under a temperature of more than 45 °C, a quantity of sand of more than 30 kg on the back or a quantity of 100 kg on the back of the animal (donkey), the Remmal travels several times between the bottom of the crater and the top of the dune to deposit the sand. These are very harsh working conditions from which the Ghout originated. According to Cote (2006) more than 180 million of tons of sand were excavated by the sand men (Remmal) on the basis of an inventory carried out by the department of agriculture of the Wilaya which gave a figure of 9700 Ghouts. Today this figure has been revised upwards since there are more than 12500 Ghout, 50% of which are currently in operation throughout the Souf Valley. Based on this new figure updated by the Department of Agriculture of the Wilaya, we evaluated the tonnage of sand excavated during the development of the Ghout per municipality. The development of these crater palm groves occupying a total area of 44500 ha required the excavation of more than 3.35 billion of tons of sand; an impressive figure which demonstrates the extent of the work carried out by the Sufis over several years.

The micro oasis of the Grand Erg Oriental

The Sahara oasis is made up of the trilogy: Water, Housing and the Palm Grove (W.H.P). The oasis of Grand Erg Occidental consists of the Foggara, ksar and the palm grove. On the other hand, the oasis of the Grand Erg Oriental is made up of the khottara (Balancer well), the dome Habitat and the Ghout (Photo.4 and Fig. 5, 6).

Photo 4: A view of the micro oasis of the Grand Erg Oriental (Photo. Souaci and Remini, 2019)

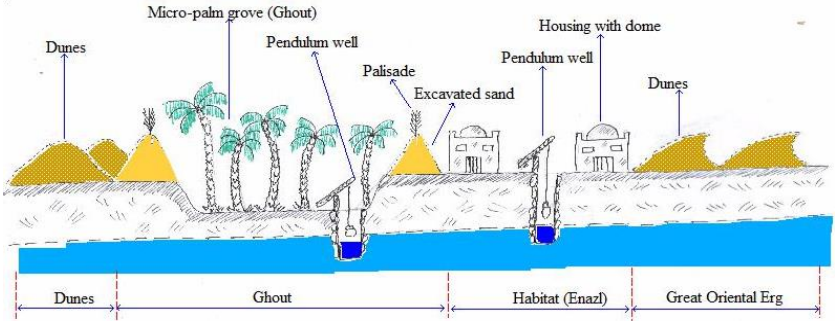


Figure 5: Diagram of a micro oasis in the Grand Erg Oriental (Scheme Remini, 2021)

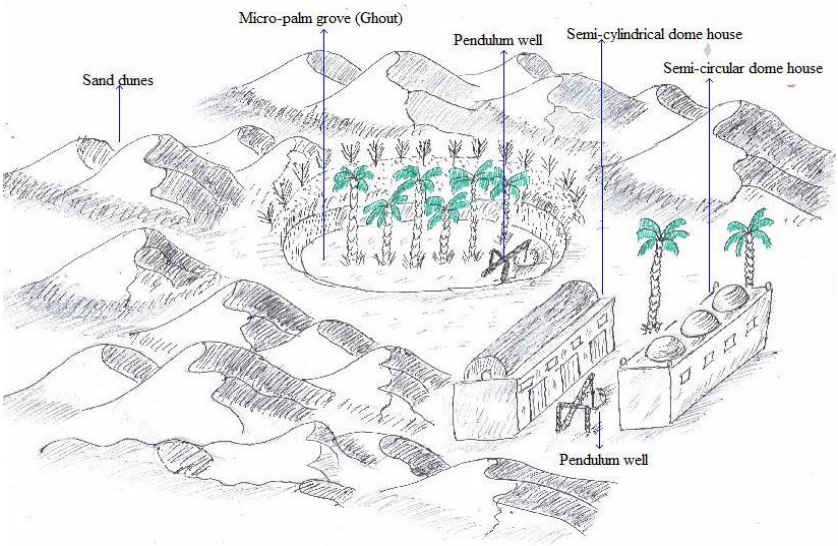


Figure 6: Synoptic diagram of a micro oasis of the Grand Erg Oriental (Diagram Remini, 2021)

Water in the oasis

Water, the source of life for a palm grove, is the fundamental element of an oasis. It is the origin of the location of the oasis. In a dry environment, where surface water is almost absent. All of its water now comes from the basement. It is the product of the deep accumulation of infiltration caused by runoff from exceptional floods. It is once the water resource (River, tablecloth, water source) exists in abundance that we decide to develop the territory of the new oasis. In the case of the oasis of Souf, the water table was the only source of water. It is for this reason that the water table was considered the lung of the

oasis. So, everything is played around this water hidden under the dunes. In addition to the water parameter, the geomorphology of the site provides security against the enemy. Unlike the majority of the ksours of the Sahara which were built on the heights of mountains and rocky massifs, the Soufis settled in a dune environment in the middle of the Grand Erg Oriental. In such cases, the enemy does not venture to cross a difficult medium like the sea of sand, the Grand Erg Oriental. If oases have been created in the M'zab valley, it is thanks to the inferoflux water table that exists under the beds of the wadis in the valley. The Mozabites use animal-drawn wells (Khottara) (Remini, 2020). On the other hand, in the Souf valley, it is rather the pendulum well (Khottara) which is more suitable for drawing water from the water table. This technique is much better suited for the hydrogeology of the Souf region. Once the sand is excavated, the water table is very close to the ground. The depth is 1 to 3 meters. Each Ghout is equipped by a Khottara not to irrigate the palm trees but rather to irrigate the garden in order to ensure self-sufficiency in vegetables and fruits (Photo. 5). There is also in the courtyard each (summer) house a pendulum well for the supply of drinking water. Animal traction, pulley and Noria wells were used in the Souf valley.

Photo 5: Souf's khottara (Photo. Souaci and Remini, 2016)

The Soufi Habitat

Unlike the other oases of the Sahara, the oasis of the Souf Valley is characterized by a dome habitat and a crater palm grove (Ghout) designated by the oasis C-C (Cupola - Crater) (Fig. 7).

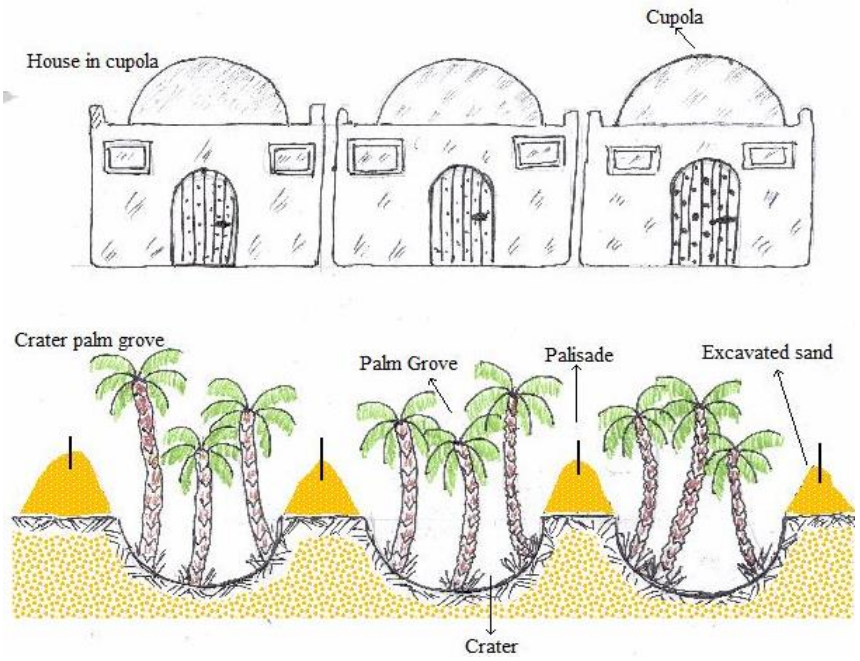


Figure 7: Oasis C-C (Cupola - Crater) (Diagram Remini, 2021)

El Oued, capital of Souf, is located 600 km as the crow flies southeast of Algiers. A tourist and agricultural town par excellence. Called city with a thousand domes following the dwellings of the region which are characterized by their roofs which are equipped with domes of semi-cylindrical and semi-spherical shapes. This type of roof, which is reserved for mosques, is a building characterizing the Soufi settlement. Unlike the ksar of the oases of the Grand Erg Occidental which is a set of houses of 1 to 2, the dwellings of Souf are individual residences (Ground floor) made up of bedrooms and a courtyard. Like the M'zab Valley, the Soufis have two types of dwellings; the first (during the winter season) in the village (Dechra) and the second, an isolated house built near the Ghout serving as a summer residence.

So, the Souf valley is very well known for its original dwellings which are equipped with cupolas (Photo.6). In addition to this essential element in the Soufi habitat, wood and more particularly the palm tree was not introduced into the habitat as in the ksours of the Grand Erg Occidental where the palm tree was used as a beam or post. The Soufi houses

were built with stone, plaster and lime. Thanks to the Soufi know-how, the dome has become an easy element to build. It is carried out even without the formwork.

Photo 6: Houses with Soufi domed roof (hemisphere) (Photo Souaci and Remini, 2016).

It should be noted that the dome was not introduced in the construction of the ksours of Touat, Gourara, Tidikelt and the Saoura. However, the dome is an element which is an integral part of the mosques of the oases of the Sahara.

The Ghout; the micro palm grove of Souf

By the way, the oasis of Souf does not resemble other oases of the Sahara like the oases of Tout, Gourara, Tidikelt, Saoura and M'zab. For this type of oasis, the palm grove is classic (continuous palm grove). In this case the water is shared among the farmers according to rules adopted by the Sages of the oasis (Tadjmat). Generally, the share of water depends on the contribution of each farmer in the maintenance and his participation in the realization of the foggara or a distribution network.

The oases are all under a single palm grove in the oasis, but each has its own garden. On the other hand, the Souf palm grove, a discontinuous palm grove divided into several micro-palm groves each has its own borders (Photo. 7). Only the water is for everyone (there is no sharing of the water between the owners). All the roots of palm trees are soaked in the water table. In addition, each micro palm grove has its own Khottara intended for the irrigation of the gardens (Photo. 8). There are two types of Ghout: small and large. The little Ghout which belongs to a single family and which contains a dozen palm trees. The great Ghout can belong to 3 to 5 families and has 100) 150 palm trees. Usually, the Ghout takes the circular shape, but there are rectangular shaped Ghouts in the north of Souf (Miloudi and Remini, 2018a, 2018b).

a) Large Ghout **b) Little Ghout**

Photo 7: The borders of the micro palm grove (Google Earth)

Photo 8: The garden of the Ghouts (Photo. Souaci and Remini, 2016)

The Ghout; the pride of a population

Today the Ghout is not known in Algeria as the foggara, even within the Souf valley. Local people are not aware of what their grandparents have achieved for about 5 centuries or simply do not assess the value of their development work. But one thing is certain; this population today is reaping the rewards of the long hard work begun centuries ago by their ancestors. It is the only palm grove in the Sahara that bears fruit; dates without irrigation and without energy. The population has never asked questions about the Soufi miracle; a palm grove that does not resemble those of neighboring regions such as Oued Righ and Ouargla for example. These palm groves require an annual irrigation water volume of several thousand m3 for irrigation. Not to mention the quantities of drainage water that requires their evacuation to a depression (Chott). This hydro-agricultural heritage, which deteriorates from year to year and may disappear in the short or medium term, deserves at least to be written down so that future generations can know the value of the Ghouts. Unfortunately, this is not the case except for the book "Si le Souf m'était" which was written by Cote in 1980, very few authors have taken an interest in the Ghouts. We have participated in making known the value of the Souf Valley through about ten articles, but it remains insufficient in relation to the sacrifices made by the Soufis. For this purpose, we have proposed a logo for the Sufi Valley will be dedicated to all the people who participated in this sand revolution (Fig. 8). Steps must be taken by the services concerned to register these Ghouts as national heritage first and then register them with UNESCO.

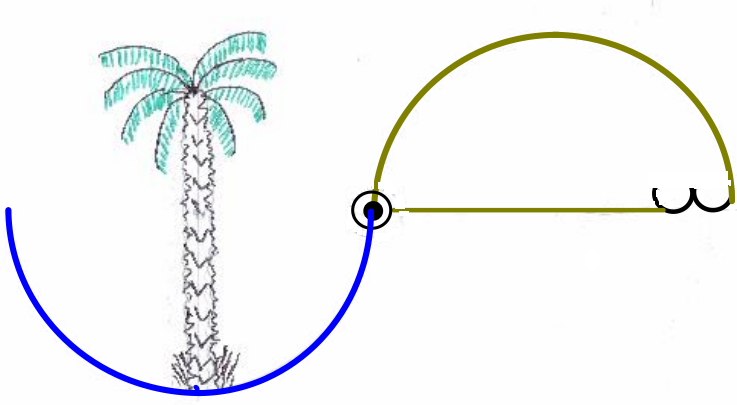


Figure 8: Logo of the Souf region (Diagram Remini, 2021)

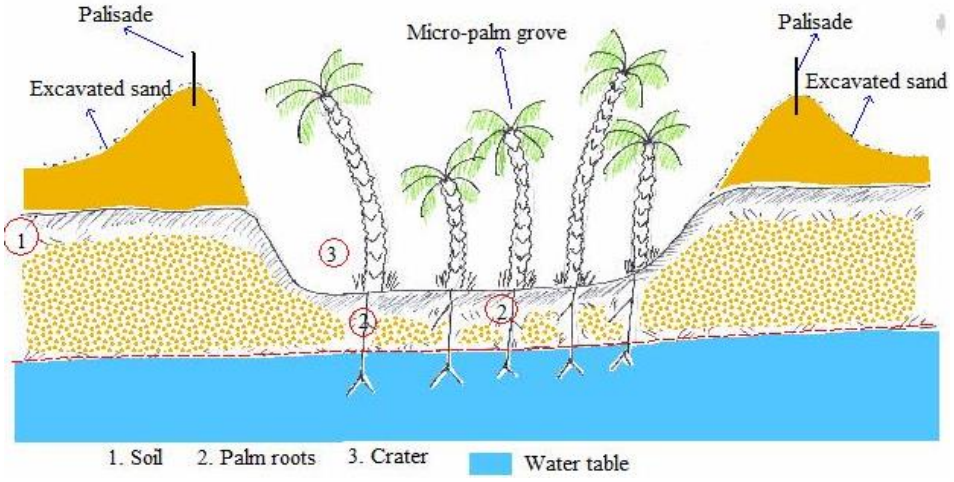
A tribute was paid to Remmal, the man of sand or the one who excavated the sand from the dunes to create craters. In the city of the capital of the Ghouts, statues were made in roundabouts in the city center. This is a man standing in a walking position on his back a bassinet (Zenbil) filled with sand (Photo. 9 a and b).

Photo 9: Statues of a Remmal in recognition of the sacrifices made by the Soufi population for more than four and a half centuries (Photo: Remini and Miloudi, 2021)

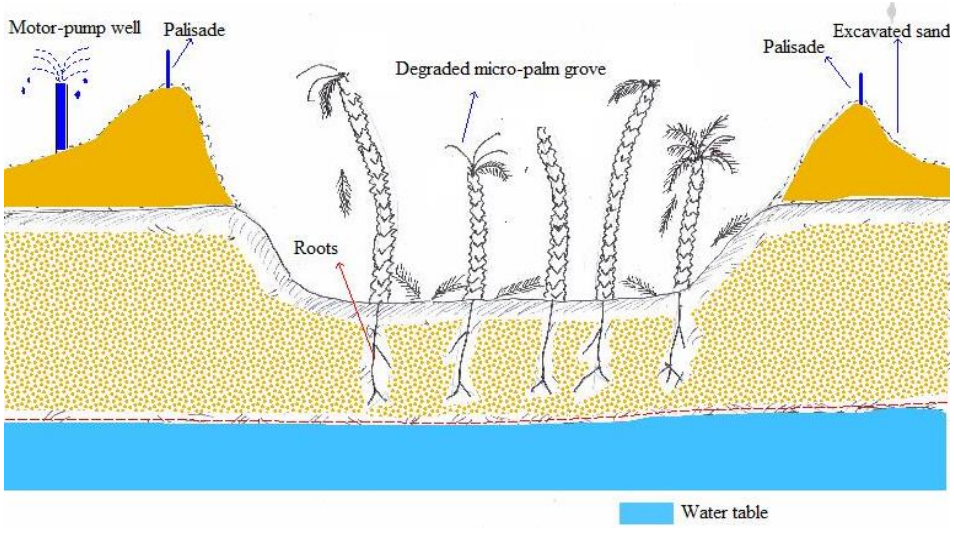
Ghouts and modern techniques (motor pumps and boreholes): the conflict

As we have already stated that dry environments do not like too much water (Remini, 2016). In a dry environment which is supposed to be a very fragile ecosystem and where water must be exploited without excess. Basement water in such an environment should be consumed moderately. Excess consumption of the underground reservoir (groundwater, the web and the web Intercalary Continental Complex Terminal) causes an imbalance of the ecosystem and even an ecological disaster. Today only the man of the oasis who understood this dry environment. He even inserted a humid environment (the oasis) in a dry environment. Quite simply, the oasien has known how to adopt hydro-agricultural techniques and developments to live in harmony with its environment. However, the contribution of new water catchment techniques to the oases of Souf in the early 1940s with the discovery of deep water tables had adverse consequences on the balance of the water table balance. The situation deteriorated from the 1980s with the launch by the then government of major projects to develop new agricultural land. At the beginning of the nineties, two hydrogeological phenomena took place in the space of 10 years which recorded the same consequences, but with different mechanisms. The first phenomenon manifested itself in the 1980s with the reclamation of agricultural lands

emerging from exhaustion zones in the north of Souf. The equipping of wells with motor pumps and repeated droughts have caused the lowering of the water table. The continued overexploitation of the water table has led to the removal of the static level from the roots of palm trees and the appearance of zones of depletion (Fig. 9 a and b).



a) Ghout in normal



b) Descent of the water table

Figure 9: Block diagram of the influence of pump wells on the Ghouts (Diagram Remini, 2021)

During this difficult period and to save their palm trees, the Soufi adopted a technique called "the descent of the palm tree" which consists in lowering the palm tree from 1 to 2 m into the ground so that its roots remain in contact with the water. the water table (Fig. 10).

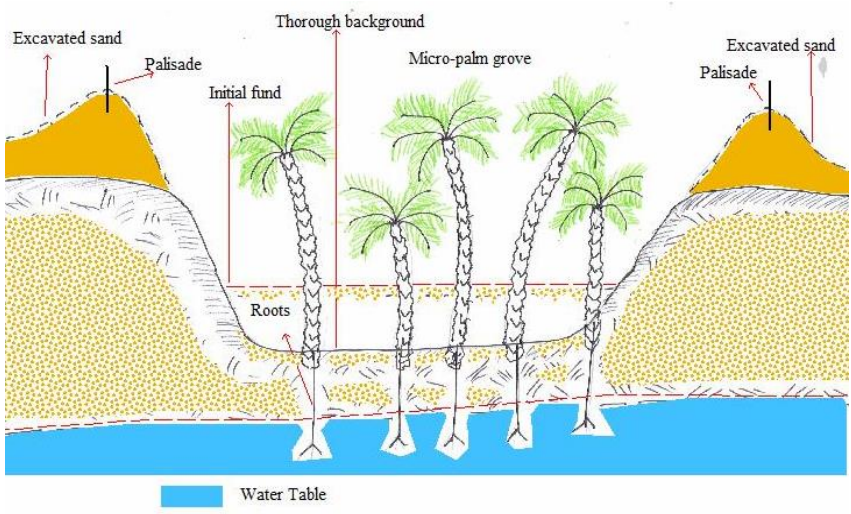
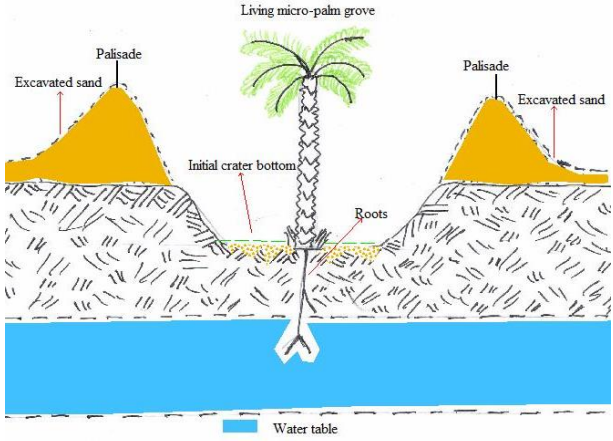


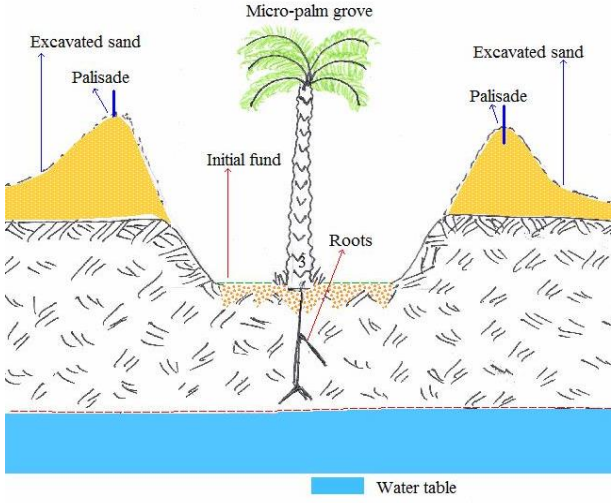
Figure 10: Synoptic diagram of the technique of "descent of the palm trees" (Diagram Remini, 2021)

During the missions that we carried out on the oases of Souf at the beginning of the nineties to study the upwelling in the Ghouts, the Sufis raised the technique of the descent of the palm tree with pride. It was thanks to this technique that several palm trees were saved in the early 1980s. According to the Soufis, this method requires 3 to 5 workers to bring down a palm tree in a period of one day. Two to three people hold the palm tree in an upright position with ropes, while one or two workers after digging a trench under the tree try to lower the tree to the water table (Fig. 11 a to e).

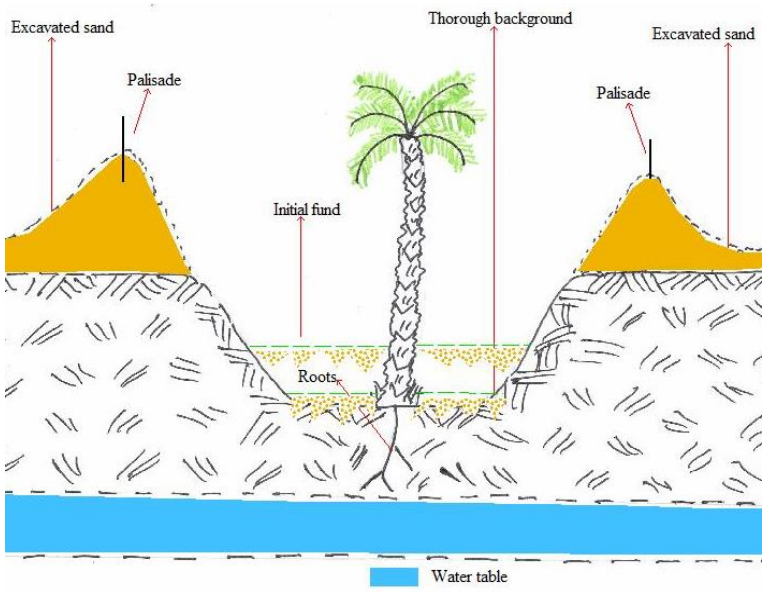
It should be noted that in the technical bibliography no article made reference to this method. Only Cote (2006) briefly examined the technique of the descent of the palm tree in his book entitled: «Si le Souf m'était conté - Comment se fait et se défait un paysage».



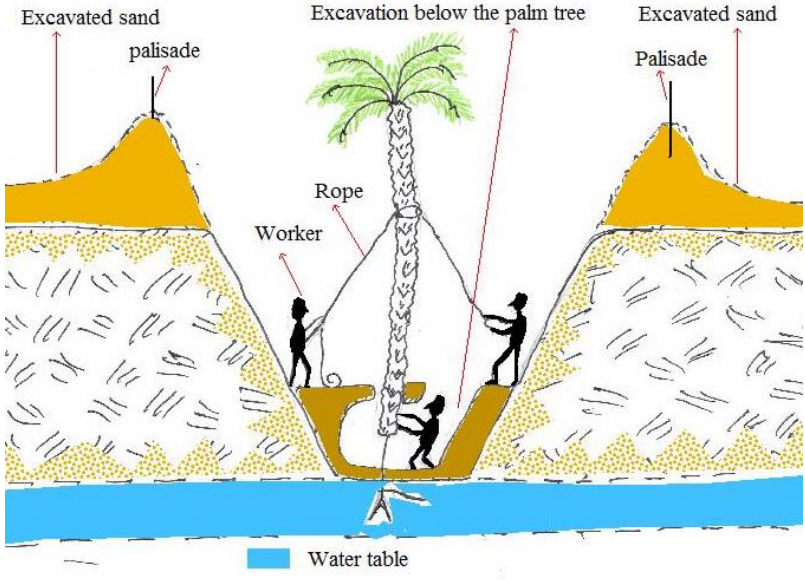
a) Ghout in normal state



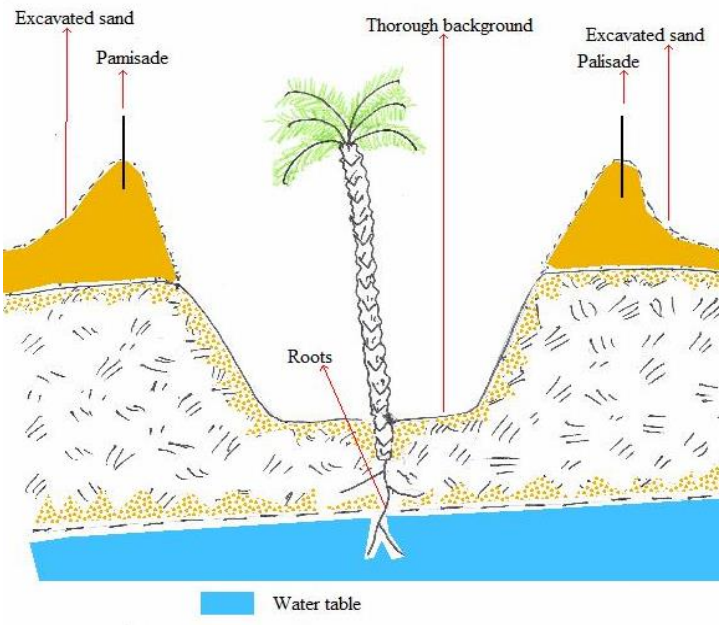
b) Lowering of the water table



c) Descent of the palm tree towards the level of the water table



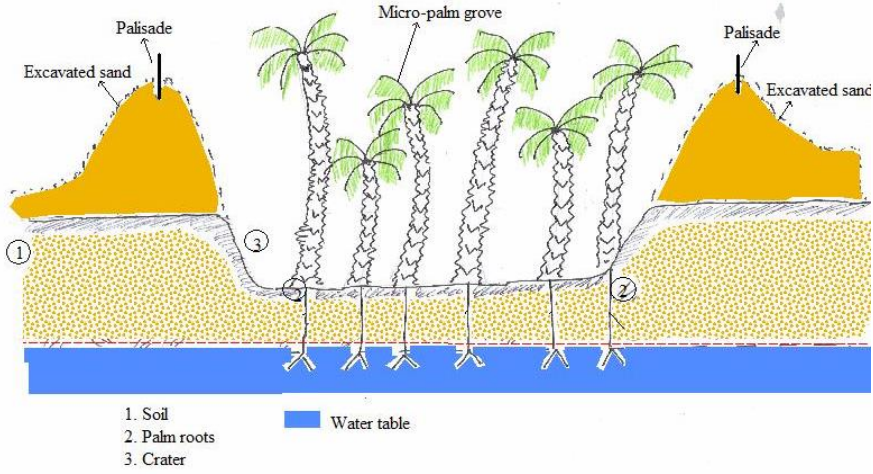
d) Digging a trench under the palm tree



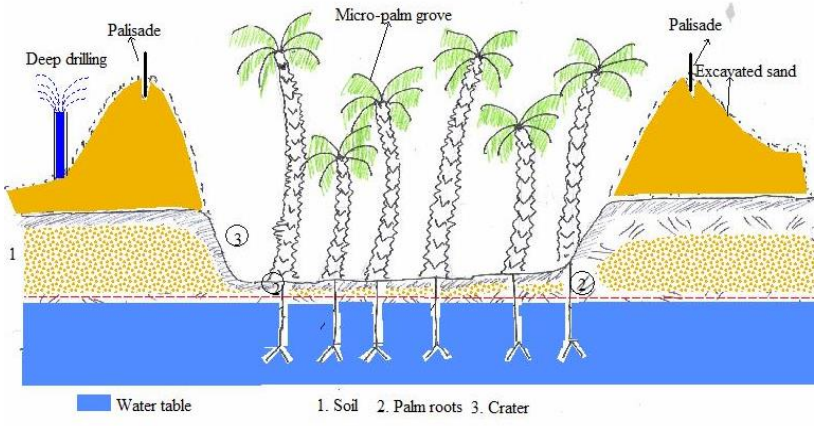
e) Normal state of deep Ghout

Figure 11: Diagram of the steps of the palm descent technique (Diagram Remini, 2021)

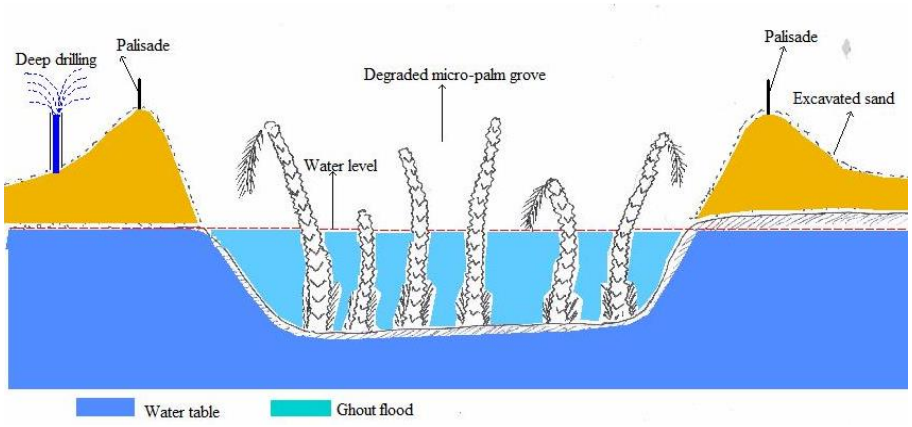
The second phenomenon which appeared in the early nineties in the center and south of the Souf Valley is practically the reverse of the first phenomenon. In the north of Souf, it is practically the emptying of the water table that has taken place. Conversely in the south of Souf, it was rather the filling of the aquifer that manifested itself. The development of new lands and the use of large quantities of water for irrigation from deep aquifers: the Intercalary Continental and Terminal Complex (Remini, 2019, Remini and Souaci, 2019). External inputs from irrigation returns continuously filled the water table. Therefore, the water takes the upward path since the water table sits bedrock. Such a situation caused the flooding of hundreds of Ghouts, not by the flooding of surface water, but rather by the upwelling of groundwater (Fig. 12 a, b, and Photo. 10).



a) Normal state of a Ghout



b) Groundwater level rise



c) Flood of the Ghouts

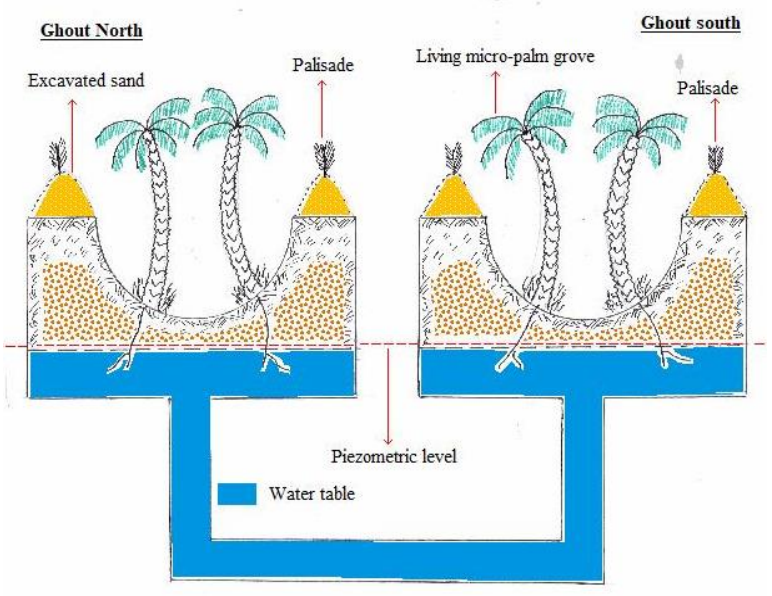
Figure 12: Synoptic diagram of the mechanism of the upwelling of the water table (Diagram Remini, 2021)

Photo 10: An example of the upwelling of groundwater in the Souf valley (Photo. Miloudi, 2006)

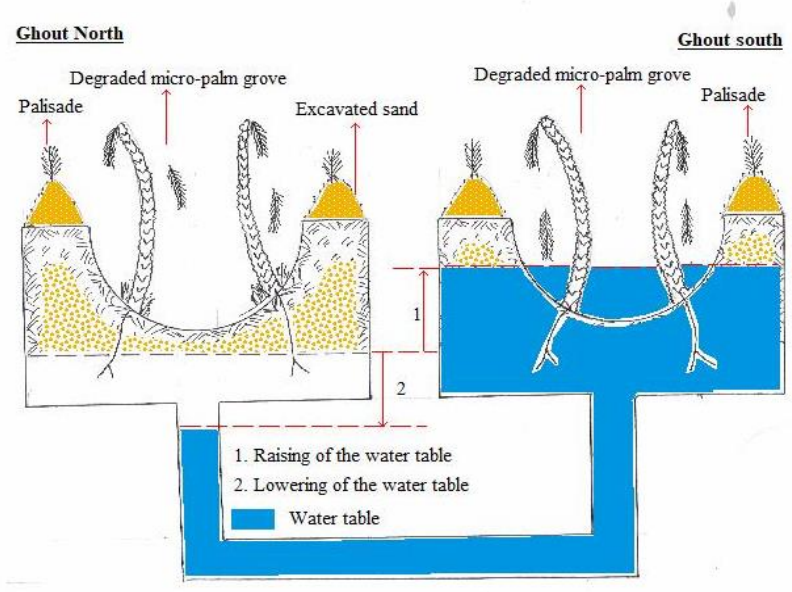
This is a completely original phenomenon in an arid environment that does not like too much water. If in the northern part, the palms died from drying out, on the other hand in the southern part of Souf, the palms died from asphyxiation (Photo. 11).

Photo 11: A view of Ghout degraded after the rise of the water table in the Souf valley (Photo. Souaci and Remini, 2016)

Either way, it was the same fate that touched all of the Souf Ghouts whether in the north or the south of the valley. The northern Ghouts are dying from the lowering of the water table. The Ghouts of the south die by the upwelling of the water table (Fig. 13 (a and b)). One thing is certain, what our grandfathers achieved for 5 centuries was destroyed for 5 years by excess water. If we keep making the same mistakes, we will see the same ecological disasters in the short to medium term. Be careful, this ecological disaster may recur in the years to come. Today, major agricultural projects have been launched in the regions of Souf and Touat. Irrigation of these new agricultural lands requires significant amounts of water which will be collected from the deep water table. Failure to control the distribution of this water will lead us directly to the same problem of the nineties.



a) Initial state of Ghout



b) End state of the Ghouts

Figure 13: Mechanisms of the ecological disaster of micro-palm groves (Diagram Remini, 2021)

DISCUSSIONS

The Sahara desert is made up of Regs, plateaus, rocky massifs, Chotts, Sebkhas and Ergs. However, Ergs remain the least accessible territories for visitors because of the presence of strong wind dynamics, the absence of water points and circulation routes. Moreover, without the presence of a guide, no one can venture into these dune places. This vast expanse of sand; a place uninhabited by the population was chosen by the Soufis to settle in the middle of the dunes and thus trace the perimeter of their territory. This location was chosen for security reasons. For example, the Mozabites settled on the heights of the rocky massifs of the M'zab valley to flee the enemy and climatic hazards (floods and floods). The Soufis knew the ideal place to flee from the enemy there is no better than the Erg. However, the necessary conditions must be created to have an environment favorable to life. This is what the Soufi adopted in the Grand Erg Oriental. These conditions come together in the presence of water and the existence of agricultural soil. These are two parameters: the water and the soil are hidden under the huge dunes of Erg. In this case, the Soufis have only one way, and that is to excavate the sand from the dunes. Once the Soufi demarcated the borders of their territory, they faced a major problem. It is that of carrying out a hydro-agricultural development on a dune ground. The first step is to excavate the sand to reach the ground. The most logical variant and the one that exists throughout the Sahara are to create an irrigated palm grove. In this case, we go to the second step, which consists of digging outrigger wells. For this type of palm grove, the problem of evacuating drainage water arises since the Souf region is a closed environment. In addition, the efficiency (Energy/Flow) of the pendulum well technique is too low. It is for this reason that this option was discarded by the Soufis. Despite its success in the oases of the Grand Erg Occidental, the foggaras system could not be installed in the Souf valley, which is a closed environment. However, the oases of Touat, Gourara and Tidikelt are open environments. Knowing perfectly the hydrogeology of the Souf valley and more particularly the approach to the static level of the water table, the Soufis have reversed the usual path. This is to bring the palm tree 1 meter from the water table. Once the roots of the tree are in contact with the water of the water table, the Soufi intervenes only for the maintenance of the Ghout and the harvest of the fruits (Remini and Hallouche, 2008; Remini, 2006). So, to achieve such a goal, the excavation of an average depth of 7 meters of sand becomes essential. The population is organized in groups or families, each one proceeds to excavate the sand in this small perimeter to obtain a crater called Ghout by the Soufis. Today there are 12500 Ghouts. This figure should be revised upwards since several Ghouts were invaded by sand and others were backfilled during the ecological disaster of the nineties (Remini and Kechad, 2011; Remini, 1999; Remini and Mainguet, 2003).

In December 2019, we carried out a mission to the oases of Souf to see the state of the Ghouts (Photo. 12). We were impressed by the agricultural development achieved by the wilaya of El Oued. "The earth advances, the sand recedes", the Soufis in just a few years, have converted arid areas into agricultural land. We even visited some new Ghouts, only today the sand excavation is done by mechanical means.

Photo 12: The authors on the sand of the Grand Erg Oriental (Photo. 2019)

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CONCLUSIONS

As we mentioned at the beginning of the text, the Ghouts played a very important role in the development of palm groves throughout the Souf Valley. Today, the Ghout has become the pride of the entire Soufi population. The Ghout is the result of Soufi genius and know-how acquired over centuries. Planted in craters built in the middle of the dunes of the Grand Erg Oriental, the Soufi have led a sand revolution for about five centuries. Move more than 3.3 billion tons of sand from their original location with rudimentary means. The Soufi converted a 44500 ha dune area into a green palm grove in the middle of the Grand Erg Oriental. A palm grove that does not look like the other classic palm grove. We called it the discontinuous palm grove, since it is formed by a set of micro palm groves arranged in craters in such a way that the roots of the plant remain soaked in the water of the water table. Locally called Ghout, the 12500 Ghouts crater palm grove today only 50% of Ghout remains. It is the contribution of the new technique of drawing water from the aquifer (motor pumps and deep drilling) at the level of the oasis of Souf that caused the swelling of the water table to the south and the deflation to the north of Souf. So, the excess and the lack of water from the water table are the causes of the degradation of this hydro-agricultural heritage. The Ghouts can be considered as one of the largest ancestral hydro-agricultural developments in the Sahara.

ACKNOWLEDGMENTS

These articles that we publish periodically in Larhyss Journal are the fruit of a long field work carried out for about 30 years in all the oases of the Algerian Sahara. This work is carried out with our own means. Our main objective is to make known the traditional hydraulic techniques which were invented by our ancestors. Without the intervention of the ksour population this study will never see the light of day. Thank you, Thank you, Thank you for all. It was thanks to you that I discovered the best country on the planet. This country is called Algeria.

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