



## THE WATER SHARING SYSTEM IN THE ZIBANS. PART 1: CASE OF CHETMA OASIS

### LE SYSTEME DE PARTAGE DES EAUX DANS LES ZIBANS PARTIE 1 : CAS DE L'OASIS DE CHETMA

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#### ABSTRACT

In the first part of this paper, we deal with the sharing of water in the Ziban region. Several soties in the oasis of Chetma were carried out during the period: 2000-2020. Data and information on the water distribution network were collected from the local population and the services concerned. The results of this study show that more than 120,000 palms are irrigated by 7 springs with a total flow rate exceeding 100 l/s. A water distribution and sharing network composed of 7 Mekssem and seguias with a total length of 4 km. Directed by a council of elders, the waters are divided by the Nouba (one after another). In addition to irrigation and domestic food, spring water produces hydraulic energy to run two mills. Today, this cultural heritage is in a very advanced degraded state.

**Keywords:** Water - Oasis of Chetma - Source - Mill - Distribution network - Water sharing.

#### RESUME

Dans la première partie du présent papier, nous traitons le partage des eaux dans la région des Zibans Plusieurs soties dans l'oasis de Chetma ont été effectuées durant la période : 2000-2020. Des données, des informations sur le réseau de distributions de l'eau ont été collectées auprès de la population locale et les services concernés. Il résulte de cette étude que plus de 120 000 palmiers dattiers sont irriguées par 7 sources d'un débit total

dépassant les 100 l/s. Un réseau de distribution et de partage des eaux composés de 7 Mekssem et des seguias d'une longueur totale égale à 4 km. Dirigé par un conseil de sages, le partage des eaux s'effectue par la Nouba (tous tours). En plus de l'irrigation et de l'alimentation domestique, les eaux de sources produisent de l'énergie hydraulique pour faire tourner deux moulins. Aujourd'hui, ce patrimoine culturel se trouve dans un état dégradé très avancé.

**Mots clés :** Eau, Oasis de Chetma, Source, Moulin, Réseau de distribution, Partage des eaux.

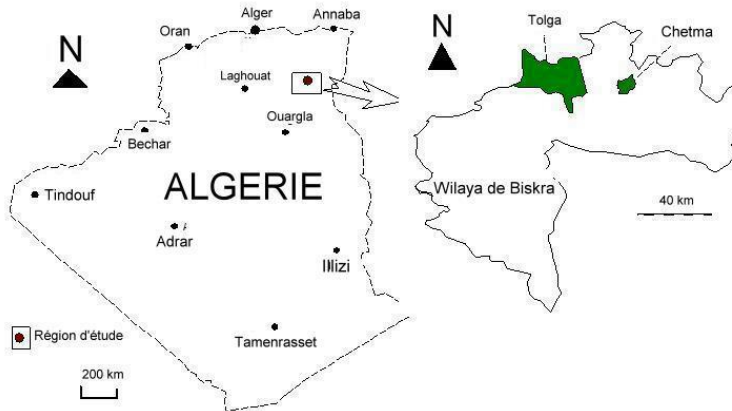
## **INTRODUCTION**

Dry environments like the Sahara are very fragile ecosystems and do not like too much water. Only savings and optimization of water can save these regions from the consequences of long droughts. Oasis people have understood that sustainable development can save oases. Two major constraints hamper life in these extreme environments. These are the difficulties of supplying drinking water and a climate characterized by temperatures around 50°C during the summer season. However, thanks to the know-how and the oasis genius, techniques for collecting water were invented. Each hydraulic system depends on the hydrogeological, topographical and hydrological conditions of the region. This is how in the Touat and Gourara regions, the oasis inhabitants have adopted the foggara system which consists of collecting groundwater and channeling it through an underground gallery to the gardens (Remini, 2017; Remini and Achour, 2016; Remini, 2019a). In the Souf Valley, another hydraulic system was designed. These are Ghouts techniques, which consist in developing palm groves in craters in the middle of the Grand Erg Oriental (Miloudi and Remini, 2018; Remini and Souaci, 2019; Remini, 2019b). In the southwestern region and more exactly in the M'zab valley, the palm groves are irrigated by groundwater by adopting animal-drawn wells called Khottara (Remini, 2018; Remini and Ouled Belkhir, 2019; Remini, 2019c; Remini, 2020a, Remini, 2020b; Remini 2020). In the extreme southwest and more exactly in the Saoura valley, it was rather the pendulum well called Khottara that was invented. Collective wells to draw a fairly large flow from a depth exceeding 6 m (Remini and Rezoug, 2017). For each of these water catchment systems in the northern Sahara, a water sharing network has been adopted according to the characteristics of the region. In the first part, we examine the condition and functioning of the water distribution and sharing network in the oasis of Chetma.

## **STUDY REGION AND WORK METHODOLOGY**

### **Situation and characteristics of the study region**

Located in the wilaya of Biskra, Chetma, a beautiful oasis is located about 400 km as the crow flies south-east of Algiers (fig. 1). For agricultural purposes, the oasis inhabitants use underground water for the irrigation of 120,000 palm trees. Chetma has an arid climate, with an average annual rainfall of around 100 mm and a temperature that can exceed 47 °C during the summer period.



**Figure 1: Situation of the study region (Remini, 2016)**

### **Methodology of work**

This study is part of a long research project adopted by the author for more than 20 years, the aim of which is to make known our hydraulic heritage. During the period: 2000-2020, several field missions were organized in the Ziban oases and more particularly the Chetma oasis. Investigations and surveys were carried out among the local population and farmers. Data and information on traditional methods of water sharing from farmers. Data on irrigation flow rates were collected from the agricultural department of the wilaya, the National Water Resources Agency of Biskra and the hydraulic department of the wilaya of Biskra.

## RESULTS AND DISCUSSIONS

### Traditional irrigation in the oasis of Chetma

A beautiful oasis located in the Ziban region 7 km east of the town of Biskra. Chetma which comes from the word Chet El Ma and which means in Arabic the edge of the water. This explains the presence of large amounts of water in the oasis. With an area of 2.80 km<sup>2</sup>, the Chetma palm grove has more than 120,000 date palms (Fig. 2). The Dachra (the city of farmers) occupies a built-up area equal to 3 ha (fig. 3).



**Figure 2: A view of the Dechra of Chetma (Photo. Remini and Hereche, 2016)**



**Figure 3: A view of the Chetma palm grove (Photo. Remini and Hereche, 2016)**

The presence of natural sources in this region with a fairly large flow encouraged man to settle and build his city. More than 7 natural water sources participated in the development of the oasis (fig. 4 and 5). Table 1 gives an idea of the importance of the flow of the sources.



**Figure 4: Source 1 (Photo. Remini et Hereche, 2016)**

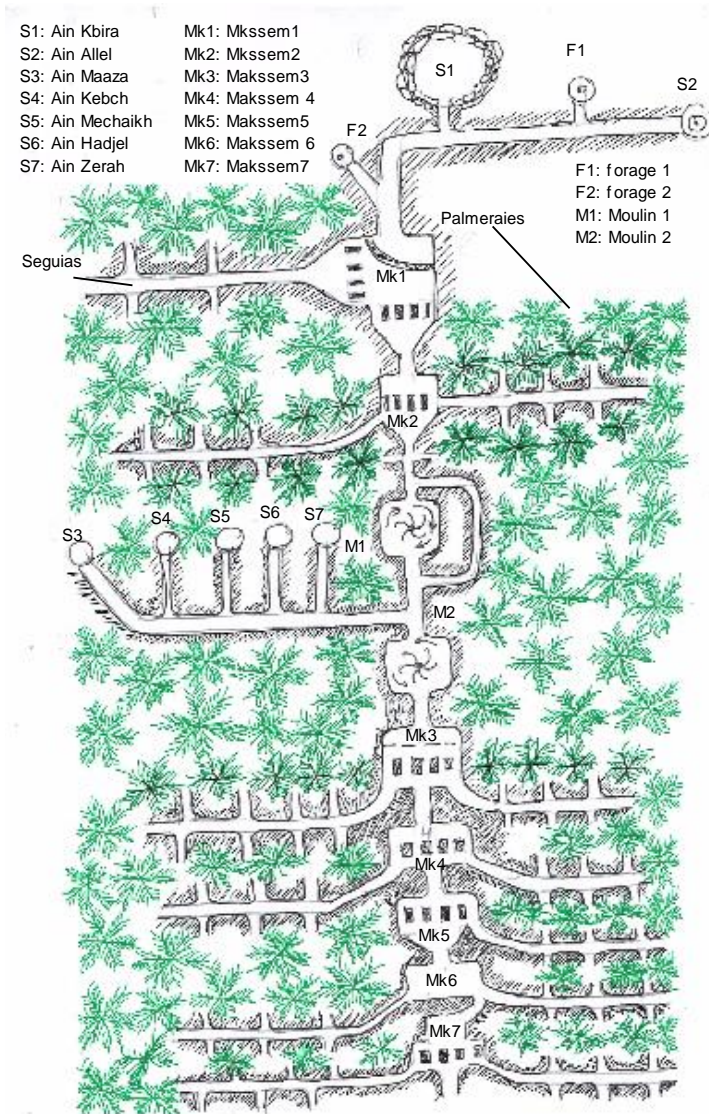


**Figure 5: Source 2 (Photo. Remini et Hereche, 2016)**

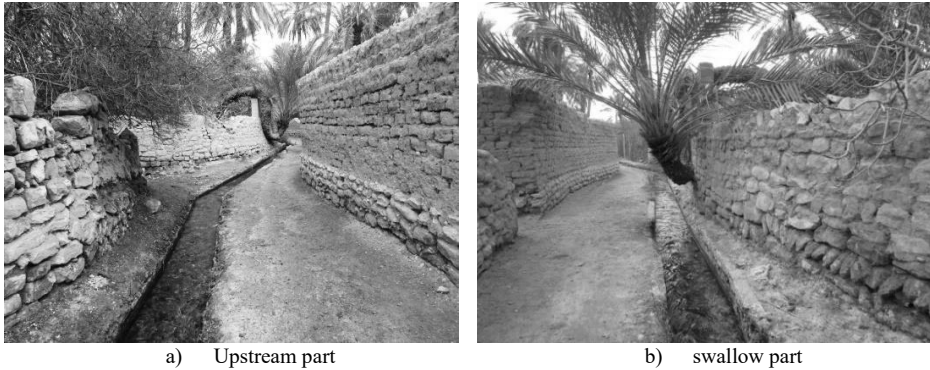
**Table 1: The flow rates of the water sources of the oasis of Chetma (Period: 1907/1908) (Roland, 1908)**

Source	Flow (l/s)
Ain allel	0.54
Ain kbira	70.57
Ain zerah	8.81
Ain mchaichk	0.4
Ain kebch	14.92
Ain hadjel	0.26
Ain maaza	3.67

This quantity of water constitutes a collective good which requires a fair sharing between the farmers of the oasis of Chetma according to ancestral laws. To this end, a distribution and sharing network has been demonstrated by the oasis inhabitants (fig. 6). This development is made up of several seguias with a total length of 4 km and 7 Mekssem (divider) (fig. 7 (a and b) and 8).



**Figure 6: Block diagram of the Chetma Irrigation Network (Diagram Remini, 2016)**



**Figure 7: A seguia in the Chetma palm grove (Photo. Remini, 2020)**



**Figure 8: A Mekssem (divider) in the Chetma palm grove (Photo. Remini, 2020)**

### **The role of watermills in the oasis of Chetma**

Intended to grind wheat, barley, chickpeas, two hydraulic mills were built in the palm grove of the oasis of Chetma (fig. 9 (a, b and c) and 10)). Unfortunately, we do not have information on the date of commissioning of these structures. Visiting hundreds of oases from all corners of the Algerian Sahara, it turns out that Chetma is the only oasis that has water mills, since the favorable condition exists in this oasis. This is hydraulic power to turn the wheel. Even a lot of water and create a steep slope to obtain a torrential flow which must flow below the Ferris wheel (fig. 11). This energy-creating mechanism spins the paddle wheel which drives the gear which in turn spins the grinding wheels. This hydraulic heritage existed in the villages of Bejaia which have perennial Rivers. However, the mills in the oasis of Chetma operated with spring water. This confirms the importance of the flow that gushed out of the soil resurgences. Unfortunately, today this ancestral

heritage is in a very advanced degraded state. There remains only the building and the steeply sloping seguia with its torrential flow.



a) Exterior



b) Interior



c) Water outlet from the mill

**Figure 9: The building of the first water mill in the oasis of Chetma (Photo. Remini, 2020)**





**Figure 10: The second mill is in a very degraded condition (Photo. Remini, 2020)**



**Figure 11: The steeply sloping seguia to create energy that spins the wheel (Photo. Remini, 2020)**

### **The role of the Mekssem in the division of waters**

We counted 7 Mekssems in the palm grove of Chetma (fig. 12). Mekssem means in Arabic the divider and looks like the kasria of the system of foggaras of Touat and

Gourara which also has the function of dividing the waters of foggaras. Except that the foggaras water distribution network adopts sharing by unit of volume (fig. 13). That is, the irrigation of the gardens is carried out in parallel (Remini, 2019a). The two figures 12 and 13 show a clear resemblance. On the other hand, the water distribution network of the foggaras in the oases of the Saoura is devoid of kasriates, it is only made up of one or two collective madjens and several seguias of different sizes made outside the gardens.



a) Mekssem 1



b) Mekssem 2



c) Mekssem 3



d) Mekssem 4



e) Mekssem 5



f) Mekssem 6



g) Mekssem 7

**Figure 12: The 7 Mekssem found in the Chetma palm grove (Photo. Remini and Harreche, 2016)**



**Figure 13: Kasria Lakbira of the foggara Meghier in the oasis by Timimoun (Photo. Remini, 2008)**



**Figure 14: A water distribution network without the Kasriates in the Boukais palm grove in the Saoura valley (Photo. Remini, 2014)**

The sharing of water is done per unit of time. In this case, we speak of linear irrigation, that is to say, irrigation that takes place in turn or through the Nouba (Remini, 2019a). What we noticed in the oasis of Chetma, the distribution network is a bit original, since it has twinned the two networks of the oases of Touat and of the Saoura in a single network. We can say that there was a transfer of know-how from Touat, Gourara to the Zibans. In this network, the Mekssem, a triangular-shaped basin with a single inlet and several outlets. Unlike the oases of Touat, Gourara, the oasis of Chetma does not have a Kial El Ma, the man who takes care of the measurements of water shares. So to carry out the operations of water sharing between the beneficiaries, a council of elders called djamaa

was installed by the local population. The selection of members is based on the integrity and honesty of each member. The water share of each beneficiary is based on their contribution to the maintenance of the network. Each part of water has its equivalent in irrigation time. Hydrometry tools were designed by oasis people. This is a sun watch (Saa chamssia) which is intended to assess the irrigation time allocated to each irrigator during the day (fig. 15 and 16). On the other hand during the night the population uses Machkouda; a system composed of a graduated and perforated copper cup at the base of the water level of the large container. The cup fills with water and drops to the bottom of the container. The time for the descent of the cup corresponds to one unit of the water part (fig. 17 and 18).

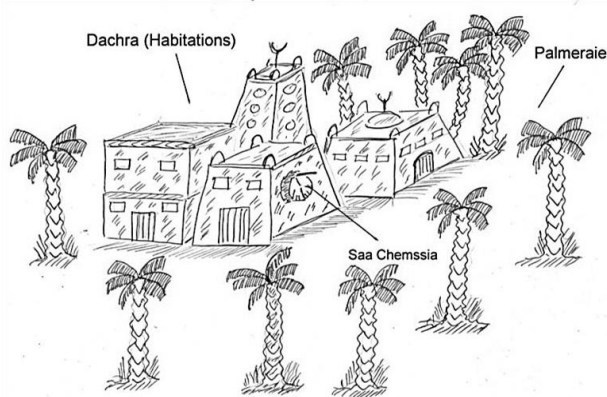


Figure 15: Approximate diagram of a Saa chemssia (Diagram Remini, 2016)

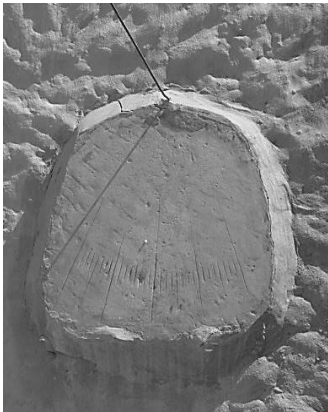
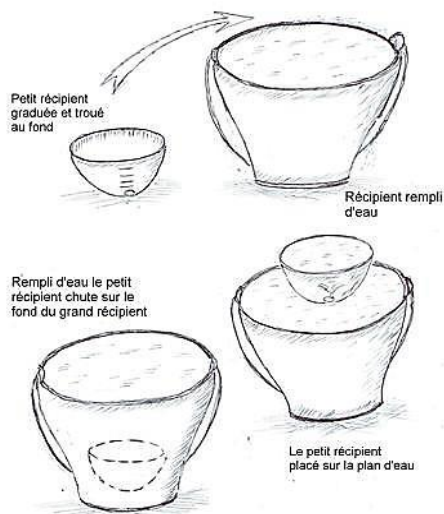


Figure 16: Saa Chemssia called Hadjra of the oasis of Moghrar (Photo. Remini, 2013)



Figure 17: Called Machkouda in the oasis of Chetma, the technique of Tassa was used in the oasis of Moghrar (Photo. Remini, 2013)



**Figure 18: Approximate diagram of the measurement process by Machkouda (Diagram Remini, 2016)**

### Degradation of the water sharing network

We have followed the evolution of the degradation of the oasis of Chetma during the last 20 years (period: 2000-2020). Indeed, we have observed with the naked eye that on each visit to the site, degradation appears in the palm grove, the houses and more particularly the distribution network. Several parts of the seguias are in a much deteriorated condition and now require rehabilitation (Fig. 19). Although the Dachra is almost abandoned except for a few houses, the irrigation of the gardens has never been stopped, since in the 1950s, motor pumps and boreholes were installed at the oasis. However, modern water catchment techniques have caused the lowering of the water table and the drying up of 5 water sources. For example, in 2013, the exploited flow was close to the value of 357 l/s as shown in Table 2. About 90% of this flow comes from boreholes. There are only two sources left: Ain Jdida (AinAllel) and Ain Kbira which give a flow rate of 23 l/s.

**Table 2: Evolution of flow in the oasis of Chetma**

Source	Rolland G (1908)	Agricultural Directorate of Biskra
Year	1907-1908	2013
Number of sources	7	2
Number of boreholes	0	32
Source flow (l/s)	100	23
Drilling flow (l/s)	0	334
Total flow (l/s)	100	357



**Figure 19: Deteriorated and abandoned Souagui (Photo. Remini and Hareche, 2016)**

## CONCLUSIONS

As we mentioned at the beginning of this paper that the spring water distribution and sharing network in the oasis of Chetma is original compared to the distribution network in the oases of Touat, Gourara and the Saoura valley. The farmers knew how to use spring water for irrigation, domestic supply and the production of hydropower. Forgotten and left to fend for itself, the oasis of Chetma is today in a very advanced degraded state. The houses in Toub are no longer habitable today. The palm grove degraded for environmental and social reasons. The water sharing system is abandoned. It is time for the services concerned to rehabilitate the oasis of Chetma, which can become a tourist region par excellence.

## ABBREVIATIONS

Ain: Water source  
Dechra: the city of farmers  
Foggara: horizontal well  
Foggara Lakbira: main foggara  
Hadjra: pierre  
Kasria: parter  
Kasriates: plural of Kasria  
Ksar: the city of farmers  
Mekssem: parter  
Madjen: Storage tank  
Saa Chemssia: sun watch  
Seguia: earthen canal  
Souagui: plural of seguia  
Toub: clay

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