

IMPACT OF THE WATER TABLE RAZING ON THE DEGRADATION OF EL OUED PALM PLANTATION (ALGERIA) MECHANISMS AND SOLUTIONS

Boualem REMINI¹, Rabah KECHAD²

ABSTRACT:

El Oued's Ghout are confronted with the phenomenon of the increase of water since about thirty years and which does not cease becoming extensive each year. The use of excessive water from aquifers of the Continental Intercalary, the Terminal Complex aquifer and the lack of a natural outlet for discharges of domestic water and industrial wastewater are the main causes of ecological imbalance. Among the problems that result from this lift, the disappearance of Ghouts and death by palms asphyxiation. Faced with this problem, various solutions have been implemented to stop this particular flood. It appears from this study that the achievement of a green belt around El Oued past two years is beginning to yield results; reducing the water level in the Ghouts is appreciable. With the completion of wastewater treatment plant (lagoon) and the use of treated wastewater in agriculture, the situation will be much more interesting in the coming years, except that the region of El Oued lose all Ghouts.

Keywords: *Ghout, Algeria, Gone up, Water, Sahara, El Oued, Deep Tablecloth.*

1. INTRODUCTION

In an arid region such as El Oued, where rainfall is almost absent, the groundwater reserves provide essential support to all human life, animal and plant. To overcome the lack of surface water, the farmers irrigates their palms plantation by groundwater. To overcome the lack of surface water, the farmers irrigates their groves by groundwater. The method of irrigating groves of El Oued is quite original: it is to get the roots of the palm into the groundwater and will be continuously in contact with water. The method of irrigating groves of El Oued is quite original: it is to get the roots of the palm into the groundwater and will be continuously in contact with water. Applying this technical reflects the farmers genius who mastered the geology and hydrogeology of the region. The population plants their palms in the crater nicknamed Ghout to reduce the depth between the ground and the roots of the palm. It is a continuous irrigation and requires no power, except that the cups require constant maintenance to prevent sand deposits.

This system was based solely on groundwater resources to ensure a balance between the needs and water resources. The economic development of the region has led to a sharp population growth and agricultural expansion. To solve the needs for agricultural water and domestic water services have used the capture of deep ground water (Terminal Complex and the Continental Intercalary aquifer).

The increased use of this resource from 1957 caused the upwelling of the top layer and grown from the eighties. The consequences are dramatic sides economically, environmentally and socially.

¹ *Department of water sciences and environments, Blida University, Blida, Algeria Larhyss Laboratory of Biskra University, reminib@yahoo.fr*

² *Faculty of Economics sciences, Blida University, Blida, Algeria, rkechad@yahoo.fr*

In this note we will discuss the mechanism and effects of the phenomenon of upwelling on the palm plantation degradation. Examples include the evolution of different solutions adopted since its inception.

2. CHARACTERISTICS OF THE STUDY AREA

El Oued is part of the northern Sahara Northeast, is bounded on the north by chotts Melghir Merouane and on the south by the extension of the largest Oriental Erg in the west through the Oued Righ valley and east by Tunisian-Algerian border (**Fig. 1**). El Oued, an oasis known for the excellent quality of these dates. Today, she is not threatened with extinction by silting, but by the upwelling of groundwater. El Oued is based on three major layers:

- Water Table;
- Complex Terminal aquifer(CT)
- Continental Intercalary aquifer (CI)

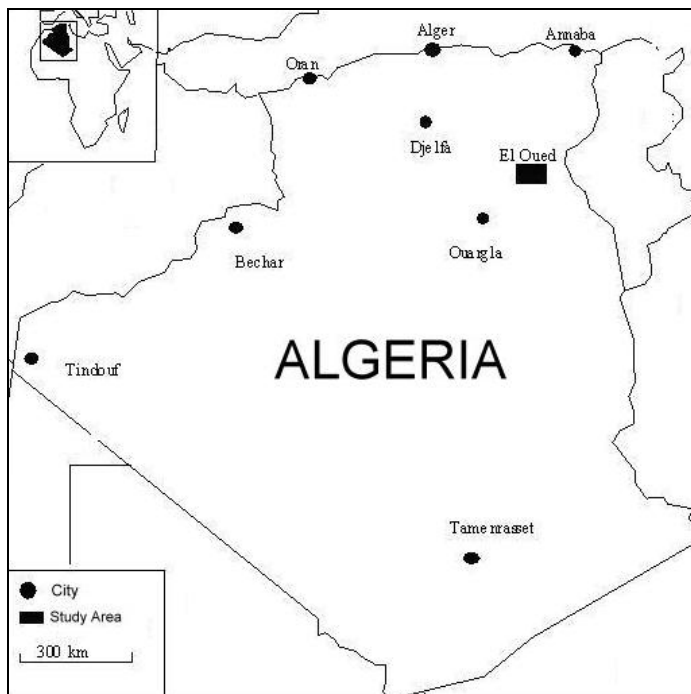


Fig. 1 Location of the El Oued

3. MECHANISMS OF RECOVERY

Ghout is a technical suitable for palm cultivation in the El Oued area, palms are planted in groups of 20 to 100 at the center of an artificial basin of a depth of 10 m and a diameter of 80 to 200 m and the bottom was taken at least 1 m above the water table (*Remini, 2001*). The farmers dig into the soil gradually so that the palm trees have their roots constantly in water, they do not need irrigation (**Fig. 2**).

The local economy is mainly based on phoeniculture localized mainly in Ghouts which approximates the number of 10000. Before the use of fossil water (Terminal Complex and Continental Intercalary aquifer) The farmers used the water of groundwater provided a balance between the needs and water resources; there was an equality between the taking away and the rejections. Benefiting from the topographic and hydrogeologic conditions favourable of the area,

the farmers have carved bowls "Ghout" to cultivate palm that gave the best dates in Algeria. The economic development of the region has led to a sharp population growth and a subsequent high water demand. To meet the water needs of agricultural, domestic and even industrial relevant departments have used the water of the two layers deep and the Continental Intermediate and Terminal Complex.

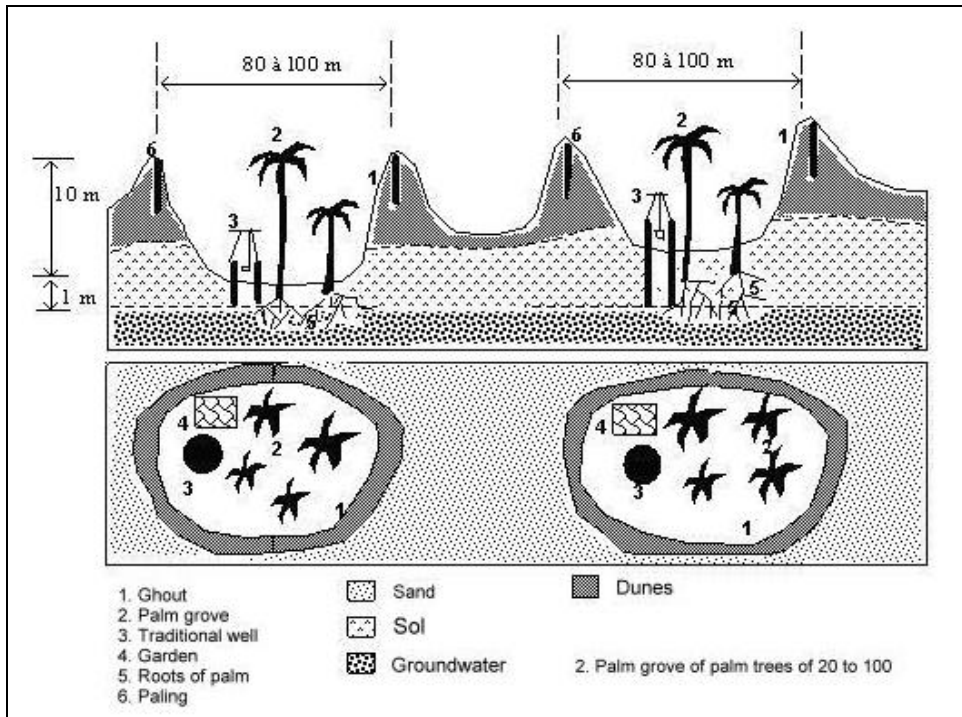


Fig. 2 Diagram of a Ghout. The palm trees have roots constantly in water, they do not require irrigation (Remini, 2003)

The exploitation of fossil groundwater began in the late fifties, the water level of the groundwater rose gradually. The first upwelling in some Ghouts appeared during the seventies. But from the eighties, with the excessive pumping of groundwater and the heavy rains of 1979 caused flooding of several Ghouts. This has caused flooding in several Ghouts (**Fig. 3** and **Fig. 4**). The exploitation of fossil groundwater began in the late fifties, the water level of the water table rose gradually. The first upwelling in some Ghouts appeared during the seventies. But from the eighties, with the excessive pumping of groundwater and the heavy rains of 1979 caused flooding, this has caused flooding in several Ghouts (**Fig. 3** and **Fig. 4**).

4. THE CONSEQUENCES OF LIFT DISAPPEARANCE OF GHOUTS

The connection rate to the water network has reached in the early nineties, over 80% while the connection rate to the sewerage system is around 30%. The remaining wastewater is discharged to septic tanks. It gives a figure of 40,000 pits left in El Oued region.

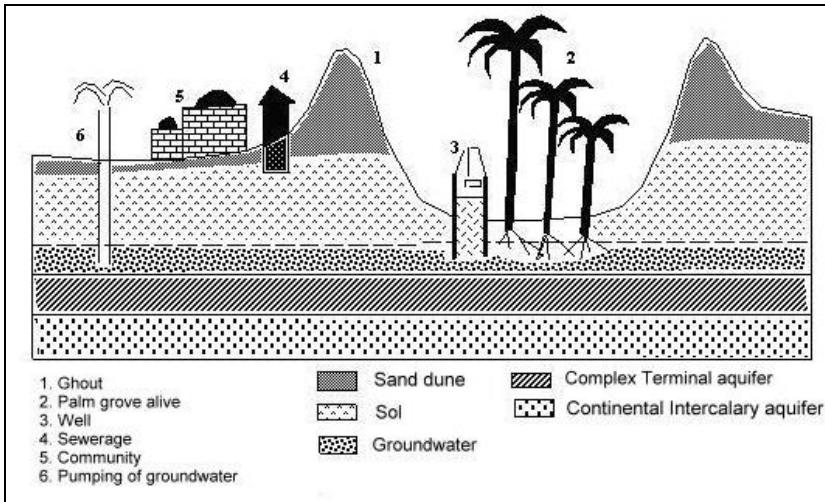


Fig. 3 Situation of the Tastes before 1960:
Balance between the taking away and the rejections

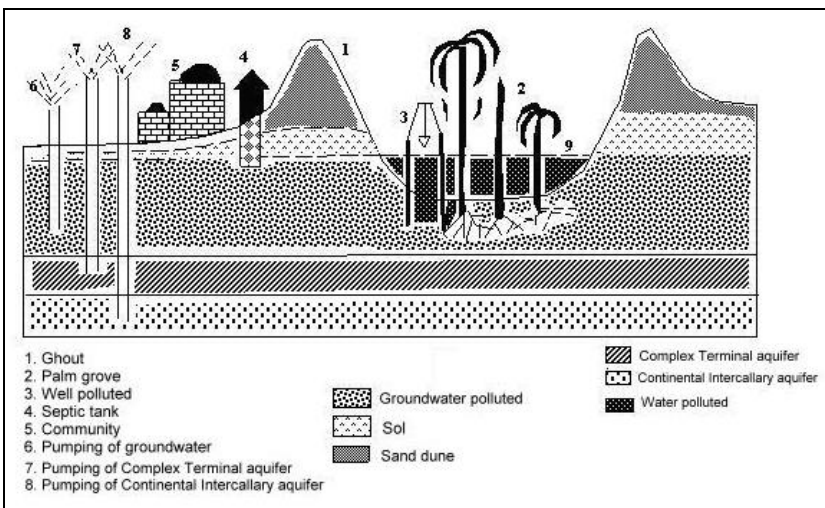


Fig. 4 Situation of Ghouts since 1980:
Increase in drillings and consequently the flow of pumping

The remaining wastewater is discharged to septic tanks. It gives a figure of 40,000 pits left in El Oued region. The extension of agricultural land has led to an increase of the pumping rate of the bottom layer, contributing through irrigation returns.

The lack of sewage outfalls and natural wastewater have imposed the only way that the infiltration into the sand to the upper layer. This imbalance of the ecosystem has led to a dramatic situation; of Ghouts or planted palm trees have been transformed into marsh reeds or take the place of dead palm trees. In 1994, the number was flooded 500 Ghouts (*DSA El Oued, 1994*). In 2000, this number is around 1000 Ghouts inundated a total of 9500 that holds the region of El Oued.

This resulted in a loss of more than 150,000 date palms, perished from suffocation. Currently, 2000 Ghouts are threatened by rising waters, more than 200,000 palm trees are degradation (**Fig. 5**).



Fig. 5 Palms of El Oued degraded due to the upwelling (photography Remini B., 2002)



Fig. 6 Ghout flooded by the rising waters (photography Remini B., 2002)

The Ghouts flooded in urban areas have become true containers of standing wastewater to a depth exceeding 1 m full of various wastes (**Fig. 6**). This critical situation is a real threat to human health: increasing water-borne diseases, release of odor, mosquitoes and insects, and the drowning of children (*Remini, 2004*). The phenomenon of upwelling has social consequences. Several homes have been abandoned by the population (**Fig. 7**).



Fig. 7 Neighborhood abandoned after the upwelling (photography Remini B., 2002)

5. EVOLUTION REMEDIES

Faced with this difficult problem, solutions have been implemented since the eighties and are as follows:

5.1. Realization of drainage and sanitation

To reduce the adverse effects of this phenomenon, the departments concerned have made a station drainage and sewerage and groundwater. The station is two menu systems: drainage of the water table and a collective system for sewage disposal. The system of drainage the water table has a water storage basin drained, three manifolds drilled 3 km long and a diameter of 300 mm and discharge a continuous flow of 45 m³/h. The collective system includes a wastewater storage basin, an extensive network throughout the area of the valley and 4 pumps for wastewater discharge. Both systems discharge to 3 km from the station into the wild near the landfill. However, it should be noted that hydraulic services are experiencing maintenance problems due to the high aggressiveness of drainage water causing rapid corrosion of the pumps.

5.2. Backfilling "Ghouts"

To save 2000 Ghouts in agricultural areas, the agricultural services of El Oued have made the realization sinks within Ghouts to pump water that is then reused for irrigation of crops around the Ghout (Fig. 8 (a and b)). It follows from this solution; more than 450 Ghouts were saved.

Some Ghouts flooded in urban areas that have a sewerage system, have been saved. The process involves pumping water to Ghouts sewerage network (Fig. 9 and Fig. 10). On Ghouts who are very advanced stage of degradation, the departments concerned have processes as an interim solution to filling to minimize the degrading state of environmental pollution in the city (Fig. 11).



Fig. 11 Backfilling operation Ghouts (photography Remini B., 2002)

5.3. Creating a green belt around the City of El Oued

Drainage systems and sanitation have not solved the problem of rising water, because of absence of a natural outlet. As mentioned previously, water (sewage and drainage) discharged to 3 km from the city will eventually return to the aquifer due to the high porosity of soil (sand) and the circuit remains closed. The creation of a greenbelt around El Oued town, consisting mainly of trees "Eucalyptus", which are irrigated at the beginning of their plantation by an irrigation system "taste to taste." This project once completed, it will be twofold. This type of plantation called "biological pump", since a single tree can consume 100 l/day can replaced the physical outlet.

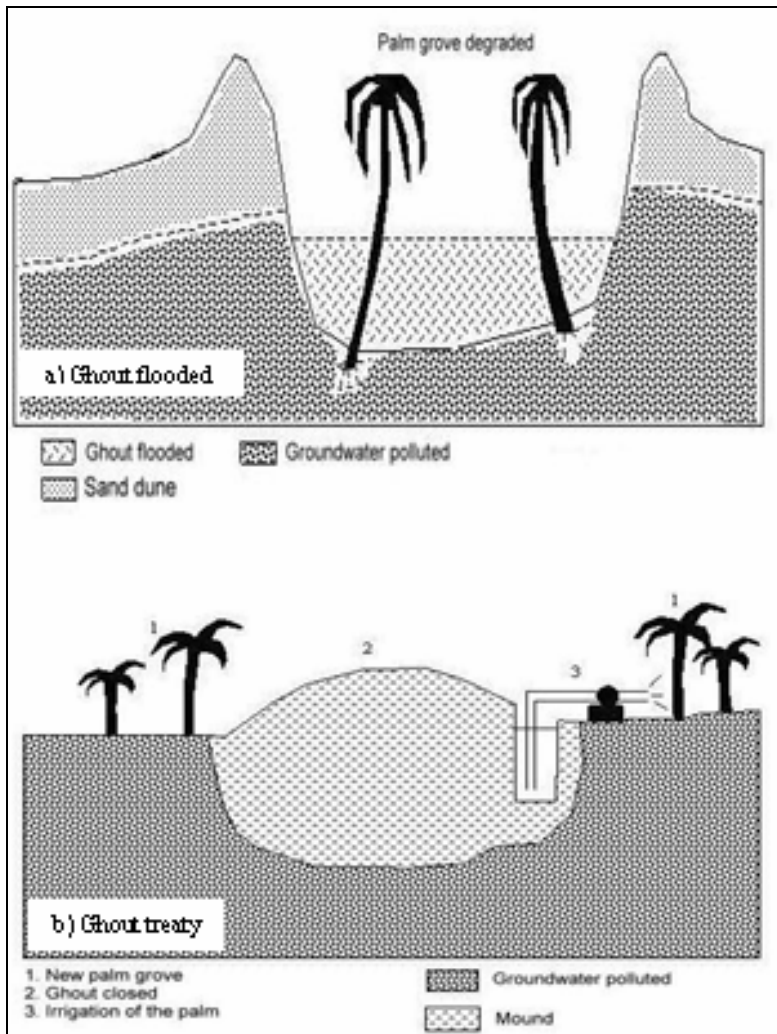


Fig. 8 Processing a Ghout in rural areas (Source DSA El Oued)

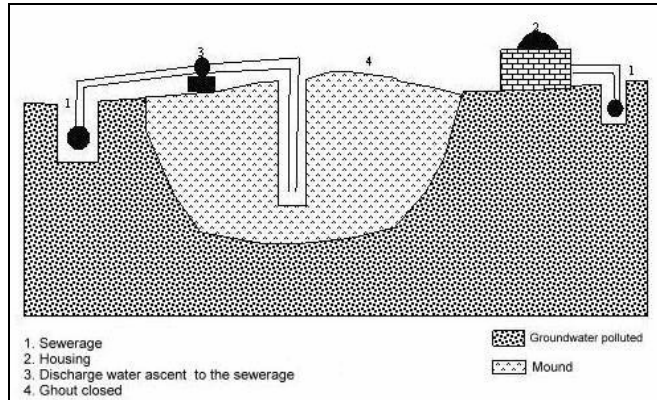


Fig. 9 Processing a Ghout in rural areas (Source DSA El Oued)

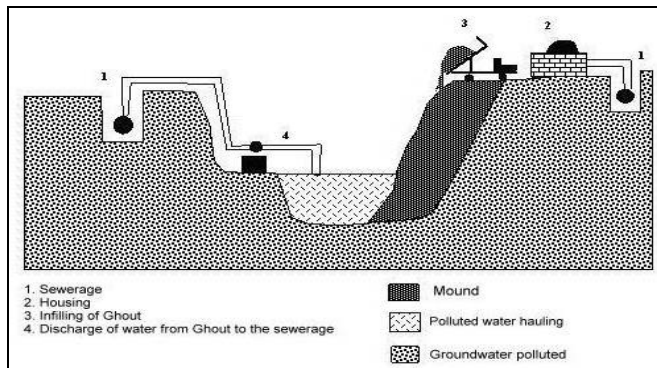


Fig. 10 Processing a Ghout in urban areas (version 1)(Source D.S.A El Oued)

Eucalyptus can directly consumed waters of the web. Second objective, the greenbelt will create a humid climate and provide wood for the population. It will probably be a way to remove and reduce siltation especially when we know that around the city are mostly positive sediment budget areas (areas of deposits). This operation starts making these fruits, because already we have seen a decline in water level in the Ghout.

5.4. Development of an agriculture-based irrigation with sewage and drainage purified

The project is initiated by the Algerian government to reduce the harmful effects of upwelling. It includes the following steps:

- Backfilling of 200 Ghouts;
- Elimination of septic tanks in urban areas;
- Extension of the sewerage network;
- Construction of sewage stabilization ponds;
- Development of an agriculture based on irrigation by treated wastewater and drainage;
- Recovery and reuse of sludge from wastewater treatment plants as soil amendment for the poor in organic matter.

CONCLUSION

The groundwater of El Oued undergoes a gradual rise since the sixties. It accelerated in the early eighties. The supply of water feeding the sheet becomes alarming and leads to flooding of many Ghouts and death of thousands of palms.

Today the situation is much more worrying, if there is no medium-term solution, even the city can be completely flooded. Several data have changed in the region in recent years, the disappearance of Artisian, lowering the groundwater level at the Chott Melghir (focal point of deep groundwater flow) and reversing the hydraulic gradient. Greenbelt composed of trees "Eucalyptus" conducted around the city seems a promising solution, since the last two years alone, a significant decrease in water level in Ghouts was found. With a basic irrigation of treated wastewater from stations lagoon, shook the situation much more interesting in the medium term, but one thing is sure, we will not see this continuous irrigation based Ghouts. But with the completion of the mega project launched by the government, the situation will improve.

REFERENCES

- DSA, (1998), *The upwelling of groundwater in the region of Oued Souf*. Synthesis Report, 10 p.
- Remini B., (2001). *Mega-barriers and their influence on the dynamic wind and sand oasis areas*, Ph.D. from the University of Reims Champagne - Ardenne Humanities - Geography option. June 19
- Remini B., (2004), *Upwelling in the region of El Oued*. Vector Environmental Review (Canada).